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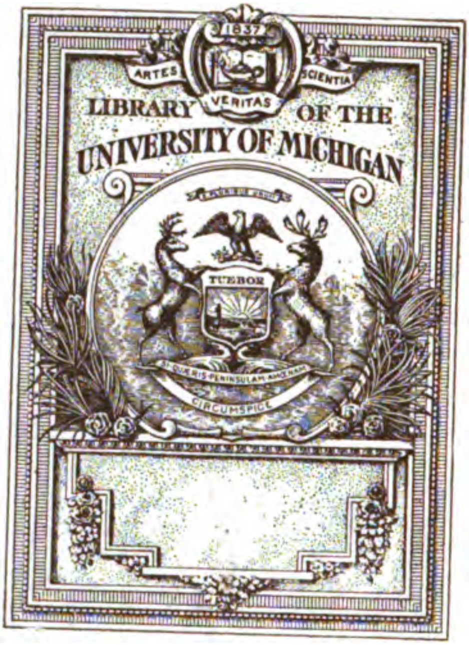

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DIAGNOSTIC THERAPEUTICS

ABRAMS

BY THE SAME AUTHOR.

Clinical Diagnosis. Third edition, revised and enlarged.

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Man and His Poisons. A Practical Exposition of the Causes, Symptoms, and Treatment of Auto-intoxication.

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Spondylotherapeutics. Spinal-concussion and the Application of Other Methods to the Spinal Region in the Treatment of Disease.

DIAGNOSTIC THERAPEUTICS

A GUIDE FOR PRACTITIONERS IN DIAGNOSIS BY AID
OF DRUGS AND METHODS OTHER THAN DRUG-GIVING

BY

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San Francisco

Naturam Morborum Curationes Ostendunt

WITH ONE HUNDRED AND NINETY-EIGHT ILLUSTRATIONS

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TO MY WIFE,

JEANNE ROTH ABRAMS,

THIS BOOK IS

AFFECTIONATELY DEDICATED.

383401

PREFACE.

The author in the third edition of his "Clinical Diagnosis" has made succinct reference to the employment of drugs in diagnosis, and, since then, he contemplated devoting a special work to this subject, which finds expression in the present volume. Although desirous of limiting himself exclusively to diagnostic pharmacotherapy, it was necessary to add other therapeutic procedures to maintain the continuity of the subject. This is neither a work on therapeutics nor on diagnosis, but an attempt has been made to conciliate both subjects with a special object in view. The author is neither a therapeutic optimist nor pessimist and he believes that more accurate clinical observations by means of objective signs would more surely establish a rational system of therapeutics. Unfortunately, therapeutic nihilism dominates scientific medicine, and pharmacotherapeutic results are attributed to suggestion or to some other recondite factor. The fact is that experimental pharmacology has migrated too far afield from the clinic. Many of the observations of the clinician are rejected by the laboratory pharmacologist unless accompanied by proof tantamount to a chemic reaction. If such scientific control is permitted, we must with equal reason exclude from our nosology all functional diseases, because the pathological anatomist cannot find lesions to explain the symptoms. The crucial test for the action of drugs is in their clinical application. Many of our most potent drugs, like mercury, opium, cinchona bark, nux vomica, etc., have been inherited from the therapeutic acumen of our medical ancestors.

In the presence of a sick man there are two questions to be answered, as Sir William Jenner said—What is the matter with him? and What will do him good? The author fully realizes that in a pioneer work of this kind many important diagnostic-therapeutic data have been unintentionally omitted. There are many physicians who are constantly using therapeutic methods for diagnostic purposes, and the author will appreciate any communications from his colleagues bearing on such methods which may prove available for incorporation in a subsequent edition of this book. Acknowledgment is made to Dr. Glentworth Reeve Butler, whose gracious permission enabled the author to employ many of his illustrations from his "Diagnostics of Internal Medicine." Thanks are also due Dr. René Bine, of San Francisco, for his contribution on the technique of the opsonic index, and to Dr. H. C. Sawyer, of the same city, for his aid in the preparation of the index.

A. A.

246 Powell Street, San Francisco, Cal.

CONTENTS.

CHAPTER I.

PAGE.

DIAGNOSIS........ 1
- Mistakes in Diagnosis........ 2
- Factors in the Etiology of Disease........ 11

TREATMENT........ 17
- Psychology of the Patient........ 18
- Psychic Factor........ 19
- Technic of Prescribing........ 22
- Table of Weights........ 28
- Incompatible Drugs........ 28

CHAPTER II.

THE INTERFERING ACTION OF DRUGS IN DIAGNOSIS........ 30

DRUGS IN THE ETIOLOGY OF DISEASE........ 43

FOOD IN THE ETIOLOGY OF DISEASE. 95

METHODS OTHER THAN DRUG-GIVING IN THE ETIOLOGY OF DISEASE........ 150

CHAPTER III.

DRUGS IN DIAGNOSIS (DIAGNOSTIC-PHARMACOTHERAPY)........ 184
- Alteratives........ 185
- Analgesics........ 203
- Anesthetics (General and Local)........ 207
- Anaphrodisiacs and Aphrodisiacs........ 229
- Anticonvulsants........ 233
- Anthelmintics........ 236
- Antimalarials........ 241
- Antineuralgics........ 248
- Antipyretics........ 249
- Antirheumatics........ 253
- Antiseptics........ 257
- Antitoxins........ 267
- Carminatives........ 287
- Cathartics........ 289
- Cerebral Excitants........ 296
- Circulatory Stimulants........ 301
- Counterirritants........ 307
- Diaphoretics........ 309
- Digestants........ 312
- Diuretics........ 314
- Emetics........ 319
- Gastric Antacids........ 321
- Hemostatics........ 325
- Hypnotics........ 330
- Organotherapy........ 335
- Parasiticides........ 355
- Protectives........ 358
- Tonics........ 359
- Uric-acid Solvents........ 368
- Vasodilators........ 369
- Miscellaneous Drugs in Diagnosis........ 385

CHAPTER IV.

PAGE.
METHODS OTHER THAN DRUG-GIVING IN THE DIAGNOSIS OF DISEASE........ 407
Abdominal Supporters........ 407
Acupuncture........ 413
Blood-letting........ 414
Catheterism........ 418
Climatotherapy........ 424
Cystoscopy........ 433
Diagnostic Dietetics........ 437
Diagnostic Electro-therapeutics........ 466
Gymnastics (Resistance and Respiratory)........ 481
Gyromele........ 538
Heliotherapy........ 539
Hydrotherapy........ 540
Hyperemia Treatment........ 544
Hypodermoclysis........ 547
Inflation........ 548
Lavage........ 554
Magnet........ 561
Massage........ 561
Pessaries........ 576
Psychotherapy........ 579
Psychrotherapy........ 599
Puncture........ 604
Radio-diagnosis........ 618
Rubber-bandage........ 650
Sounds........ 657
Strapping........ 663
Suspension........ 666
Tamponade........ 667
Transillumination........ 668
Tuning-fork........ 671
Vacuum-therapy........ 674
Vibratory Massage........ 677

CHAPTER V.

ETIOLOGIC-DIAGNOSTIC-THERAPEUTICS........ 681
Previous Diseases........ 681
Diatheses........ 703
Special Periods........ 725
  Childhood........ 725
  Puberty........ 735
  Menstruation........ 735
  Menopause........ 736
  Marriage........ 737
  Pregnancy........ 741
  Puerperium........ 745
  Lactation........ 746
  Senility........ 747

CHAPTER VI.

THE DIAGNOSIS OF VISCERAL SUFFICIENCY........ 748
The Circulatory System........ 748
  The Heart and the Blood-vessels........ 748–793
The Respiratory Apparatus........ 793
The Glandular Organs........ 815
  Suprarenal Glands........ 815
  Thymus Gland........ 816
  Thyroid Gland........ 816

PAGE.
The Liver...816
The Kidney..828
Mammary Gland...844
The Pancreas..845
The Stomach...851
The Intestines..868
The Blood...879
The Nervous System..903
    Brain...903
    Spinal Cord...903–966
    Cerebral Nerves...966
Muscular Sufficiency..986
Test of Condition...998
The Foot...1000
Pelvic Sufficiency...1007
Vertebral Insufficiency..1014

BIBLIOGRAPHY...1015

INDEX..1025

PLATES.

PLATE.	FIG.		FACING PAGE.
I.	4.	Auto-massage for constipation	129
II.	21.	Method for palpating the abdomen	209
III.	29.	Method for executing testicular massage	346
IV.	34.	Position for eliciting the knee-jerk	380
V.	35.	Position of leg for palpating the tibial artery	381
VI.	48.	Motor points	468
VII.	49.	Motor points	468
VIII.	50.	Motor points	468
IX.	51.	Motor points	468
X.	52.	Motor points	468
XI.	53.	Motor points	468
XII.	53a.	Motor points	468
XIII.	53b.	Motor points	468
XIV.	76.	Topographic relations of the stomach	551
XV.	81.	Position for eliciting the Achilles tendon-reflex	564
XVI.	128.	Diagram of the respiratory center	794
XVII.	147.	Cortical localization of the motor and sensory functions	906
XVIII.	148.	Motor pathways in spinal cord	906
XIX.	149.	Sensory pathways in spinal cord	906
XX.	152.	Effects of lesions in the motor path of brain and cord	912
XXI.	153.	Distribution of the sensory cutaneous nerves	918
XXII.	154.	Distribution of the sensory cutaneous nerves	918
XXIII.	167.	The base of the brain	966
XXIV.	168.	Points of exit of the cranial nerves	966
XXV.	170.	Visual paths	969
XXVI.	172.	Snellen's test-types	974
XXVII.	190. 191. 192.	Illustrating Jacobson's method of pelvimetry	1007
XXVIII.	193. 194. 195.	Illustrating Jacobson's method of pelvimetry	1008

ILLUSTRATIONS.

FIG.		PAGE.
1.	Sphygmogram of an inhibited heart	56
2.	Resting attitudes of culex and anopheles	109
3.	Actinomyces	113
4.	Auto-massage for constipation . . . *Plate I, Facing*	129
5.	Effect of insufflation of the stomach on the heart	136
6.	Effect of insufflation of the stomach on the heart	136
7.	Dullness in dislocation of the heart	137
8.	Dullness in dislocation of the heart	137
9.	Shadow cast by a dislocated heart	138
10.	Illustrating the appearance of coagulated blood	151
11.	Clinical viscosimeter	152
12.	The urethra in prostatic hypertrophy	154
13.	The elastic Mercier	154
14.	Stomach-tubes	163
15.	The Kuttner aspirator	164
16.	Illustrating the method of Storck	165
17.	Maneuver of Hueter (anatomic picture)	166
18.	Maneuver of Hueter	167
19.	Points of puncture in pericardial exudates	173
20.	Anterior wall of the thorax with pericardium	174
21.	Position for executing palpation of the abdomen . . . *Plate II, Facing*	209
22.	Illustrating anesthesia of the teeth by cocain	222
23.	Morton's high-frequency electrode	224
24.	Diagram of nerves which stimulate the respiratory centers	228
25.	Rectal irrigators	260
26.	Capillary tubes for obtaining the opsonic index	272
27.	Hammer and pleximeter for concussion	291
28.	Crystals of uric acid	308
29.	Method of executing testicular massage . . . *Plate III, Facing*	346
30.	Myxedema before and after treatment with thyroid extract	350
31.	Illustrating the heart reflex	375
32.	Heart reflex in a neurasthenic	376
33.	Heart reflex (normal) and in an arteriosclerotic	376
34.	Position for eliciting the knee-jerk . . . *Plate IV, Facing*	380
35.	Position of leg for palpating the tibial artery . . . *Plate V, Facing*	381
36.	Sphygmogram of the anterior tibial artery	382
37.	Apparatus for injecting olive oil	397
38.	Relation of the stomach to other organs	403
39.	Dullness dependent on fluid in the stomach	404
40.	Abdominal supporters	411
41.	Scheme for the mechanism of the bladder-functions	419
42.	Luys' separator	433
43.	The separator in the male bladder	433
44.	The separator in the female bladder	434
45.	The separator in a dangerous position	434
46.	Harris' instrument fitted for use	436
47.	Interrupting electrodes	467
48.	Motor points . . . *Plate VI, Facing*	468
49.	Motor points . . . *Plate VII, Facing*	468
50.	Motor points . . . *Plate VIII, Facing*	468
51.	Motor points . . . *Plate IX, Facing*	468

FIG. PAGE.
52. Motor points..*Plate X, Facing* 468
53. Motor points..*Plate XI, Facing* 468
53a. Motor points..*Plate XII, Facing* 468
53b. Motor points..*Plate XIII, Facing* 468
54. Application of the sinusoidal current to the abdomen.................. 475
55. Perimeter of the abdomen before and after the abdominal application of the sinusoidal current.. 478
56. Pleural spaces.. 488
57. Pleural spaces.. 488
58. Atelectatic patches.. 489
59. Atelectatic patches.. 489
60. Fluoroscopic reproduction of the lung-apex.. 491
61. Extreme area of apical resonance.. 492
62. Stethographic tracings before and after application of the rubber-bandage to the chest.. 504
63. Position of the diaphragm after the use of bandage.. 505
64. Tracings from the fluoroscope of the lung-apex.. 505
65. Tracings from the fluoroscope of the lung-apex.. 506
66. Bottles for promoting lung-contraction.. 511
67. The vibrosuppressor.. 515
68. Illustrating excursions of the diaphragm.. 519
69. Phonendoscopic attachment.. 528
70. Sphygmogram in inhibition of the heart.. 535
71. Turck's gyromele.. 538
72. Method of employing the solar rays in tuberculosis.. 539
73. Sphygmomanometer for controlling hyperemia.. 545
74. Auscultation tube for the ear.. 548
75. Politzer's bag.. 548
76. Topographic relations of the stomach..............*Plate XIV, Facing* 551
77. Gastrodiaphane.. 552
78. Gastrodiaphanic picture (normal).. 553
79. Gastrodiaphanic picture of a dilated stomach.. 553
80. Gastrodiaphanic pictures in gastroptosis.. 553
81. Position for eliciting the Achilles tendon-reflex.......*Plate XV, Facing* 564
82. Echinococcus elements.. 606
83. Crystals of nitrate of urea.. 607
84. Diagram of an abscess.. 615
85. The orthodiagraph.. 627
86. The principle governing the orthodiagraph.. 628
87. Heart reflex in myocarditis.. 629
88. Right anterior oblique position.. 630
89. Radioscopic examination of the aorta.. 631
90. Aortic reflex.. 635
91. Aortic reflex.. 635
92. Aortic reflex.. 635
93. Varicose veins in sciatica.. 654
94. Fluoroscopic picture of the lung-apex.. 655
95. Fluoroscopic picture of the lung-apex.. 655
96. Dennison's method of restricting respiratory mobility.. 656
97. Bougie à boule.. 660
98. Method of passing a sound into a normal uterus.. 660
99. Passing the sound into a retroverted uterus.. 661
100. Girdner's telephone bullet-probe.. 662
101. Method of strapping the abdomen.. 664
102. Method of strapping the abdomen.. 664
103. Method of strapping the abdomen.. 664
104. Coakley transilluminating set.. 669
105. Tuning-fork for testing hemianesthesia.. 673
106. Tuning-fork for auscultation.. 673
107. Middle-ear aspirator.. 675
108. Vertebral concussional reflexes.. 678

Fig. Page.

109. Illustrating dislocation of the tympanitic area in the right iliac region.... 685
110. A mouth-breathing boy.... 701
111. Position of the hand for testing the nervous condition.... 713
112. The shape and size of the non-pregnant uterus.... 742
113. The shape and size of the uterus in early pregnancy.... 742
114. Scheme of the cardiac cycle.... 749
115. Auscultatory areas of the cardiac valves.... 749
116. Diagram of the cardiac cycle and sounds of the heart.... 750
117. The cardiosplanchnic phenomenon.... 769
118. The abdominal compressor.... 770
119. Bock's stethophonometer.... 774
120. Sphygmomanometer of Riva-Rocci.... 786
121. Rubber ring for inhibiting auto-pulsations.... 787
122. Boundaries of the heart and great vessels.... 789
123. Method of taking a sphygmogram of the aorta.... 790
124. Tracings of the abdominal aorta.... 791
125. Cephalograms.... 793
126. Terminal bronchus.... 794
127. Illustrating the physical signs of bronchitis.... 794
128. Diagram of the respiratory center.... *Plate XVI, Facing* 794
129. Spirographs.... 810
130. Apparatus for nasal-filtration.... 811
131. Instrument for measuring the diameters of the chest.... 812
132. Cyrtometer.... 812
133. Pneumatometer.... 813
134. Spirometer.... 814
135I. Section of a Malpighian capsule and tuft.... 829
135II. Epithelial elements of a Malpighian capsule.... 829
136. Diagram of the uriniferous tubes.... 830
137. Cryoscope.... 838
138. Section of the human pancreas.... 846
139. Boas-Oppler bacillus.... 857
140. Vago-visceral and stomach reflexes.... 861
141. Test-diet feces.... 875
142. Hemocytometer.... 895
143. Counting-chamber for the blood-corpuscles.... 896
144. The Bloomfield blood-counter.... 898
145. The neurone (diagrammatic).... 904
146. Cortical localization.... 905
147. Cortical localization of the motor and sensory functions *Plate XVII, Facing* 906
148. Motor pathways in spinal cord.... *Plate XVIII, Facing* 906
149. Sensory pathways in spinal cord.... *Plate XIX, Facing* 906
150. Arteries at the base of the brain.... 907
151. The cerebral sinuses.... 906
152. Effects of lesions in the motor path of brain and cord... *Plate XX, Facing* 912
153. Distribution of the sensory cutaneous nerves.... *Plate XXI, Facing* 918
154. Distribution of the sensory cutaneous nerves.... *Plate XXII, Facing* 918
155. Distribution of the sensory cutaneous nerves.... 919
156. Skin-areas corresponding to spinal-segments.... 923
157. Skin-areas corresponding to spinal-segments.... 924
158. Speech apparatus of the child.... 930
159. Illustrating the conception of an object.... 930
160. The left Sylvian artery.... 931
161. Section of the human semicircular canal.... 935
162. Diagram of semicircular canals.... 935
163. Relation of the spinal-segments to the roots and exits of the spinal-nerves. 954
164. Mechanism of the deep reflexes.... 958
165. The Babinski toe-reflex.... 960
166. Cross-section of the spinal cord.... 963
167. The base of the brain.... *Plate XXIII, Facing* 966

FIG. PAGE.
168. Points of exit of the cranial nerves................*Plate XXIV, Facing* 966
169. Visual color-field of the right eye.................................... 967
170. Visual paths..................................*Plate XXV, Facing* 969
171. Section of the eyeball.. 973
172. Snellen's test-types..........................*Plate XXVI, Facing* 974
173. Jaeger's test-types... 975
174. Astigmatic dial... 976
175. Keratoscope... 976
176. The Maddox rod.. 977
177. The Maddox rod test in orthophoria.................................. 978
178. The Maddox rod test in orthophoria.................................. 978
179. Illustrating the ramifications of the facial nerve.................. 981
180. Dynamometers.. 994
181. Kellogg's dynamometer... 995
182. Posture of the hand in testing neuro-muscular fatigue............... 996
183. Ergograph... 996
184. Impressions of normal feet..1002
185. Illustrating the effects of high-heeled shoes........................1002
186. Impression of a flat-foot...1002
187. Impression of a foot (metatarsalgia)................................1004
188. Impression of a flat-foot...1004
189. Illustrating the line of Meyer......................................1006
190. Illustrating Jacobson's method of pelvimetry..
191. Illustrating Jacobson's method of pelvimetry.. *Plate XXVII, Facing* 1007
192. Illustrating Jacobson's method of pelvimetry..
193. Illustrating Jacobson's method of pelvimetry..
194. Illustrating Jacobson's method of pelvimetry.. *Plate XXVIII, Facing* 1008
195. Illustrating Jacobson's method of pelvimetry..
196. Measuring the transverse diameter of the outlet.....................1009
197. Instrument for measuring the conjugata vera.........................1011
198. McDonald's method of cephalometry...................................1012

CHAPTER I.

I. DIAGNOSIS; II. TREATMENT.

Diagnosis:—Mistakes in diagnosis; Factors in the etiology of disease—heredity, age, sex, nationality, occupation, previous residence, habits, previous diseases, seasonal prevalence of disease, diurnal exacerbation of disease, periodicity, atmospheric pressure. Treatment:—Psychology of the patient; Psychic factor; Ethics of untruth; Technic of prescribing; Varieties of the prescription-writer; Table of weights; Incompatible drugs.

I. DIAGNOSIS.

The antiquated aphorism, *Qui bene dignoscit, bene curat,* is generally applicable in the medical practice of to-day. I say generally, when one recalls the neurologist whose specific function appears to be to diagnose but not to treat nervous diseases. This is no reproach to the latter, for the reason that his therapeutic resources are limited. The medical diagnostician is not unlike the veterinarian, for, similar to the latter, his diagnosis is often grounded on objective signs. He must depend largely on the Baconian or inductive method of ratiocination in contradistinction to the deductive method. The former analytic method of diagnosis is a conclusion drawn from concrete facts. One only infrequently arrives directly at a conclusion (*direct diagnosis*), and for that reason recourse must be had to *differential diagnosis,* which compels one to compare all diseases which bear like symptoms. After this fashion, a *diagnosis by exclusion* is made when disease after disease is eliminated until one is encountered which is found to be the correct one. While the scientific diagnostician strives to make the clinical correspond with the anatomic findings, or, in other words, pictures to his mind the pathologic conditions prevailing in disease, the less radical physician is often content, and reasonably so, with a *functional diagnosis.* The latter takes cognizance of anomalies in the physiologic functions of the viscera. Thus a functional takes precedence over a *pathologic diagnosis,* for the reason that physiologic fluctuations may be resident in an organ even before a pathologico-anatomic substratum is assumed to exist. The advances made in the pathology and therapeutics of the stomach have been mainly along the lines of functional diagnosis. Wunderlich declared that, "pathology is the physiology of the sick"; and Gowers says, "The diseases of which we know the least pathology are the diseases which we treat successfully."

There are many physicians who are adepts in gathering all the subjective and objective data of disease, yet who are hopeless amateurs in their inferences. The principles of logic are always applicable in all conclusions from the testimony of disease—the symptoms. No physician can assume skill in diagnosis until he has mastered the rules and principles of logic. Accurate observation and correct reasoning are essential in diagnosis, or, as Huxley puts it, "The man of science, in fact, simply uses with scrupulous exactness the methods which we all habitually and at every moment use carelessly." Disease is the sphinx of medicine. The interpretation of the signs constitutes diagnosis, which is the Œdipus of medicine; the translation may be correct, partially correct, or wrong. In all three instances the result, as far as the patient is concerned, will, as a rule, be the same, provided no treatment is instituted. To treat a disease other than by expectant methods, where the diagnosis is in question is adding insult to injury.

Mistakes in diagnosis may be attributed to the following causes:

1. Incomplete or careless examination.
2. Misinterpretation of symptoms, due to errors in judgment.
3. Ignorance of the methods of examination.
4. Prejudiced preconception.
5. Incompleteness of medical diagnosis.
6. Placing too much reliance on the results of the treatment.
7. Incomplete history of the patient and the incomplete development of the symptoms.
8. Simulation or dissimulation on the part of the patient.

Incomplete or Careless Examination.—Sir William Savory tritely remarked, "Consciousness of one's ignorance may do much to avert the errors of carelessness, and he who has confidence in his own judgment should of all men be most careful in inquiry." It has been said that it is more necessary for the physician to take great pains than to have big brains. Pasteur declared, "I do not know. . . . . I will investigate."

There is a large group of nervous diseases which admit of instantaneous diagnosis, and, in fact, the subsequent examination merely confirms the primary impression. *Paralysis agitans* presents an unmistakable clinical picture: the marked inclination of the body forward, the attitude of the fingers, as if employed in holding the pen, the immobile facial expression, and the peculiar gait as if the patient were about to tumble forward. The pulsating struma and exophthalmos portray the tableau of *exophthalmic goiter*. To the initiated eye, the gait furnishes an adequate clue to immediate diagnosis, and in such instances the term *ambulant diagnosis* seems apropos. The spastic, steppage, ataxic, waddling, and hemiplegic gaits are pathognomonic. Only the untrained eye could fail to recognize the emphysematous patient who enters the room in comparative comfort and with pronounced cyanosis.

Diagnosis is not always thus easily achieved; on the contrary, it is usually a slow and tedious process, demanding the most exalted medical skill. The patient who expects the physician to make an immediate diagnosis is a believer in miracles, and, carrying his absurdity to extremes, predicts like results from treatment. Such a patient should be admonished to consult Providence, not a physician.

An examination based according to a conventional form, allowing no region or organ of the body to escape analysis, will do much to avert errors.in diagnosis, for it is unquestionably true that mistakes in diagnosis are not so much due to ignorance as to carelessness. Some one has said that the chief function of the consultant was to examine the rectum, for the evident reason that it is often overlooked in our hasty examinations. I recall a patient who was intrusted to me by an eminent colleague during his absence in Europe. He said on leaving, "The patient has a carcinoma ventriculi, and all that you can possibly do is to secure euthanasia." For some unaccountable reason the rectum of the patient was examined and found to contain an enormous scybalum, the removal of which was followed by immediate recovery of the patient. The patient in question said that she had a movement daily. Such statements must always be accepted with reserve. Not infrequently the fluid elements of the feces pass, but the solid constituents adhere to the walls of the bowel, a condition known as the diarrhea of constipation. Sir William Jenner observed, "More mistakes are made by want of looking than by want of knowing."

With our present-day refined methods of diagnosis, with the patient as an object of clinical dissection, every available resource is utilized, and the skilled diagnostician must in consequence be an adept in bacteriology, prolix laboratory methods, etc. The time is fast approaching when medical men will be differentiated as diagnosticians and therapeutists, for the former will have neither the time nor the inclination to treat the sick. The genesis of therapeutic nihilism was contemporaneous with augmented refinement in diagnosis, and it is safe to assume that, if as much skill had been expended in advancing therapeutics as has been done to abet diagnosis, the periodic psychic infections like Christian Science and other cults of that category would never have come into existence, or at least their continuance would have been ephemeral.

Misinterpretation of Symptoms Due to Errors in Judgment.—Under this caption mistakes arise, as a rule, from: (1) Placing too much reliance on the subjective symptomatology; (2) giving undue prominence to one symptom to the exclusion of others; (3) grouping symptoms which are the effects of disease, and not the disease itself.

We are frequently led astray by subjective symptoms. There is no disease or symptom of disease which cannot be simulated by *hysteria*. Indeed, the definition of Möbius faithfully portrays this most protean of all diseases: "A state in which ideas control the body and produce morbid changes in its functions." In hysteria, as in other psychoneuroses, we are actually dealing with mental diseases; fixed ideas become dominant, *i. e.*, attention becomes so firmly fixed to a simple thought that all others which do not harmonize with it are eliminated from consciousness. I have coined the word *ideopath* to designate an individual whose apparently sole affliction is some morbid idea. It is quite evident that the subjective symptoms of such patients are only valuable in a negative direction. The euphoria of the paretic and the deplorable mental state of the neurasthenic belie their respective conditions. Symptoms are so variously interpreted by the morbid mentality of the patient that in the realm of subjective symptomatology there are but few pathognomonic signs. Yet in many functional diseases the objective are often subsidiary to the subjective symptoms, for it is often more necessary to know "what kind of a patient the disease has got than to know what sort of a disease the patient has got." Mistakes in diagnosis frequently occur by grouping symptoms which are the effect of disease. It would appear, at times, as if in our struggle to establish a diagnosis it would be better to make none at all, rather than group symptoms under such equivocal expressions as neurasthenia, spinal irritation, hypochondriasis, etc. The diagnosis in many functional troubles means nothing, whereas the cause means everything; hence the importance of *etiologic diagnosis.*

The diagnostic acumen of the physician is frequently taxed in dissociating cause and effect. Undue prominence of one symptom may mask others. In health all organs work harmoniously, and in disease they functionate inharmoniously. The vicious circle thus established requires a master-mind for its interpretation. One is less likely to err if one is commonly disposed to regard symptoms as manifestations of disease rather than the disease itself. Just in proportion as we follow this rule such conditions as pyuria, hematuria, hemoptysis, the secondary disturbances in visceral diseases, etc., will be relegated to their proper sphere, and cause will not be confounded with effect. Many functional troubles have no definite pathology, and all hypotheses which hint in that direction have not exceeded the realms of theory. We may regard such troubles as mere reactions to repeated stimuli. One organ is dependent on the other for the normal performances of its work. If one suffers, they all suffer; yet some one organ, the point of least resistance, it may be the heart, the stomach, or the liver, usually bears the brunt of the functional anomaly.

Virchow, in 1880, formulated the following conclusions:

First: An elementary diseased process consists of an external influence (*the cause of disease*) acting upon a living cell and altering it in a mechanical or chemical manner. The altered condition is disease.

Second: The cell-reaction so varies that in one instance the cause may bring about only irritation, in another only a disturbance, and in still another instance paralysis of the cell.

After all is said, etiology is one of the most important factors in diagnosis, and without it no interpretation of disease can be regarded as conclusive.

Ignorance of the Methods of Examination.—Haste in examination and misinterpretation of symptoms must be annexed to this heading. In this connection I recall the familiar anecdote of the peasant who was told that a certain optician could furnish him with glasses to enable him to read. Glass after glass was tried, yet the peasant declared that he could not read. Finally after many unsuccessful efforts the optician discovered that the peasant never could read. One must not postulate that the possession of a microscope carries with it the possession of a knowledge of microscopy, any more than the possession of glasses enables the illiterate owner to read. "Cancer specialists" often thrive on the mistakes of expert microscopists. One could indite a tome on the misinterpretations of radiographs; and many unfortunates have been consigned to valetudinarianism by the mistakes of the possessor of an *x*-ray machine. It is not the apparatus but the man behind it who interprets. We employ our senses in a dual direction—objectively and subjectively. We have a mind's eye, ear, nose, touch, etc. One may see an object a thousand times, yet unless the mind's eye (subjective vision) co-operates in the act of vision the picture is never developed in the mind and the picture-memory and interpretation are correspondingly obscured. We attain our acquaintance with the world through our senses, but we apperceive with our minds. Ignorance of the methods of examination frequently leads one to diagnose nephritis because albumin is present in the urine, or diabetes because sugar is found, and heart diseases because murmurs are heard. I have known of several instances where phosphates in the urine have been mistaken for albumin. Locomotor ataxia has been diagnosed, based merely on the fact that the patellar reflex was not elicited.

Prejudiced Preconception.—In this connection mistakes frequently arise from two causes: (1) placing too much reliance on the history of the patient; (2) being misled by first appearances.

Making a diagnosis deductively frequently conduces to error. Like the critic who never read a book before he had reviewed it, because he might be prejudiced, so with the physician—he should not learn the history of the patient before he examines him. Diseases present such varying pictures that with a prejudiced mentality we can see almost anything we want to see. Much of the mind's activity is suggested thought or unconscious thinking, which is uncontrolled by the will. The personal history of the patient should be used only when possible in confirming the examination. In physical diagnosis the physician frequently betrays his prejudiced preconception. If he detects a cardiac murmur, the delimitation of the organ is made to accord with the conception of enlargement. If he suspects a certain disease, he unconsciously frames his questions in such a way to the patient that the latter, accepting the suggestion, replies accordingly. In the presence of abdominal pain the surgeon who uses his head as well as his knife thinks of appendicitis, but, when he uses his knife to the exclusion of his head, he thinks of nothing else.

There is the gynecologist whose conception of disease is limited to the uterus and adnexa, and there is the oculist with mental astigmatism, who reflects his subjectivity in the examination of his patients. Every physician has his visceral fetish or, as Zimmerman in his treatise on "Experience" observes, there is a tendency to patronize special organs, diseases, or remedies. Molière ("Malade Imaginaire") also ridicules this tendency, and as the patient relates each symptom to the physician, the latter nods his head and remarks, "Le poumon! justement le poumon"; and when the patient concludes, he again exclaims, "Le poumon! Le poumon!" The poet Crabbe immortalizes this visceral fetishism in verse:

> One to the gout contracts all human pain,
> He views it raging in the frantic brain;
> Finds it in fevers, all his efforts mar,
> And sees it lurking in the cold catarrh.
> Bilious by some, by others nervous seen,
> Rage the fantastic demons of the spleen;
> And every symptom of the strange disease,
> With every system of the sage agrees.

If suggestion were not rampant, there would not be so many successful specialists, nor even systems in medicine, for the multitude of homeopaths, hydropaths, osteopaths, and other "paths" demonstrate that all paths lead to cure. One is frequently led into error by mistaking a subjective for an objective pulsation. Place the index-finger, or preferably the middle finger, against the styloid process of the radius, where there is no pulsation, and very often one experiences pulsations which are essentially subjective. The latter are more manifest when the observer has a high blood-pressure. Thus it is that I have frequently detected tracheal tugging and aneurismal pulsations which in reality did not exist. To avoid errors of this kind, which I am convinced are not infrequent, I count such pulsations, to determine whether they correspond in number with the pulse of the subject. Some years ago I experimented with phosphorescent calcium sulphid by applying it as a paint to the chest, and I thought I could see the movements of the heart and the play of the diaphragm. Very soon I abandoned my investigations because the glare of the phosphorescent light made my vision so untrustworthy that I could almost see what I wanted to see. However, several years later what I thought I saw was given to the world as the N-rays.

Incompleteness of Medical Diagnosis.—When disease runs a typical course diagnosis is, as a rule, facile; but when the affection is atypical, then errors are frequent. The diagnosis of many atypical infectious diseases is often only problematic. Take typhoid fever as a paradigm. There is no infectious disease more protean in its infinite variety. If the typhoid bacilli have been isolated and the agglutination test employed, we have absolute proof that we are dealing with a mild, abortive or afebrile form of the disease; otherwise our diagnosis remains in doubt. It is by this method of control that we are able to disprove such an affection as typho-malarial fever, and prove by the same means that both diseases may coexist. After the same fashion we have nullified the value of many drugs vaunted as specifics for aborting the disease in question. What is true of typhoid, applies with equal cogency to diphtheria and many other infectious diseases. Our modern methods of diagnosis are equivalent to an autopsy on the living subject in either proving or disproving our conclusion. We must be willing to acknowledge that our diagnostic methods are not complete, for by so doing we are often in a position to transfer the burden of responsibility to our art. The frank brutality of Frerichs rudely illustrates how a great clinician acknowledged the incompleteness of medical art. After an exhaustive examination of a patient, he was in doubt about the diagnosis. The patient insisted, however, upon knowing the nature of his trouble, and Frerichs is said to have quieted him with the assurance that the diagnosis would be determined at the autopsy.

Placing too much Reliance on the Results of Treatment.—We are frequently led into error by mistaking recovery for cure. There are a few diseases for which we possess specifics. Psoriasis is frequently mistaken for syphilis, and as the former often disappears spontaneously, the success of antisyphilitic medication might be regarded as confirmatory evidence. Tabes dorsalis and paralytic dementia are regarded as parasyphilitic, and both diseases often show temporary periods of amelioration; hence, if specific medication were employed at such times, one would be likely to ascribe the apparent improvement to treatment. Even malaria may get well spontaneously without special medication. We must not forget that the usual tendency of a pathologic process is toward a physiologic ending. Etiologic diagnosis is often influenced by the success following the treatment of many so-called reflex neuroses. The success is largely a question of suggestion, and is predominant in affections of a neurotic nature. Asthma is a disease which might develop by mere association of ideas. I recall a patient a sufferer from asthma. Three polypi were removed from his nose and his paroxysms ceased. Two years later he consulted me for another trouble, and after inspection of his nostrils as a routine procedure, a number of polypi completely obstructed his right nostril. He was informed of the result of the examination, and that night he had an asthmatic attack, the first one in two years. We recall the experiment of MacKenzie, who induced an attack of hay-fever by offering the patient an artificial rose to smell. Any psychic stimulus sets up directly an altered visceral condition which is followed by the automatic employment of agencies which tend to combat it. I recall a patient who had characteristic symptoms of pyelonephritis. As a placebo, washing of the bladder was done, and I was surprised to find that after a few washings there was no longer any pus in the urine. An autopsy showed calculous pyelonephritis of both kidneys and an absolutely normal bladder. A patient was brought to my office for severe pains in the knee-joint which failed to yield to successive methods of treatment. Before prescribing, the knee was examined before the *x*-rays, after which she was dismissed and told to come again the following day. She had accidentally mistaken my examination for a treatment, for when she returned she said that the pains had entirely disappeared after a single treatment.

Incomplete History of the Patient and the Incomplete Development of Symptoms.—The construction of a diagnosis without a history of the patient is like practising veterinary medicine. In some instances the patient's recital of his symptoms is valueless owing to misinterpretation, exaggeration, and even an underestimation of the feelings experienced. A patient with diabetes or tabes may suffer from nearly all the symptoms of these diseases, and yet will not consult a physician until impotency develops. Verily, pain, fear of death, and impotency are the chief factors which prompt a patient to consult a physician. Diagnosis must be held in abeyance in many instances owing to undeveloped symptoms. In this category belong the eruptive fevers and many acute infections. A protracted diagnosis may be eminently scientific, yet to the laity it is construed as an admission of ignorance. It is at this time that the therapeutic resources of the physician must be invoked, and he must make a greater show of doing something when he is doing nothing, for, "The patient wishes not only to be cured, but to be treated: his luxury is in the importance of the physician and his remedies." The charlatan appreciates the value of the anamnesis. The advertisers of asthma-cures send out blanks to be filled by the patient containing many questions, and in one instance I counted fully two hundred of the latter. The physician who is an adept in cross-examination may elicit many facts from the patient which would be overlooked by the average practitioner. Even with an extensive history, the physician is liable to err if he fails to distinguish between testimony and evidence. The latter, in its legal acceptation, refers to "the means by which any alleged matter of fact, the truth of which is submitted to investigation, is established or disproved." Diagnosis should rest on evidence and not on assumption and inference. Dr. M. L. Harris[1] illustrates the difference between an assumption, an inference, and a conclusion as follows: A patient is suffering from a disease of one kidney, which may require removal. The question which first suggests itself is, Has the patient two kidneys? The proposition would be as follows:

1. Most men have two kidneys.
2. This is a man.
3. Therefore, this man has two kidneys.

The major premise contains the word *most*, which at once subdivides men into at least two classes, while the minor premise contains nothing indicating to which class the particular man belongs. Therefore no conclusion can be drawn, and if we regard this particular man as having two kidneys, it is a mere assumption. If urine can be collected by the segregator in the two vials, some evidence is furnished on which may be based an inference that the patient has two kidneys. If further evidence is forthcoming that the separate urines could not have come from the same organ, then the conclusion is warranted that the individual in question has two kidneys, and this fact may now be employed in reaching further conclusions. It is evident, then, that a conclusion cannot be based on an assumption or an inference, but must rest on the facts themselves. A history of heredity may assist in the diagnosis of a host of affections: insanity, neuroses, cutaneous affections, rheumatism, tuberculosis, obesity, diabetes, alcoholism, gout, cardiac troubles, asthma, etc.

Age.—Here many important data may be elicited. Epileptic attacks occurring in a person of over thirty without a history of previous seizures suggest organic disease, and in nine cases out of ten the cause is syphilis (Fournier). General paralysis is most common between the ages of thirty and fifty-five, and commencing in childhood, it is caused by congenital syphilis. Diabetes mellitus in children is almost invariably fatal. Migraine, in women, usually ceases after the climacteric, and in men after the age of fifty. A third of all the cases begin between the fifth and tenth years of age (Gowers). Bladder-troubles occurring in males in middle or old age suggest prostatic trouble. Hereditary syphilis usually appears before the fifth year, but may occur up to eighteen years.

Gout is rarely encountered before the age of thirty. In gastric affections we rarely think of carcinoma in the young subject, knowing, as we do, that three-fourths of the cases occur between the fortieth and seventieth years; on the other hand, gastric ulcer occurs chiefly in females between the ages of fifteen and twenty-five. Gall-stones are rare under twenty-five (Osler).

Sex.—Some diseases are more frequent in one sex than in the other. A few only can be cited as examples. True angina pectoris is rarely encountered in women (out of two hundred and thirty-seven cases of Huchard, forty-two only were in women). Three-fourths of all cases of gall-stones occur in women. Movable kidney is more common in women (out of six hundred and sixty-seven cases of Kultner, five hundred and eighty-four were in women and eighty-three in men). Hysteria is rare in males. Tabes is more frequent in males than females, the proportion being nearly ten to one. Hemophilia, chloroma, appendicitis, and aneurism of the abdominal aorta largely preponderate in males, whereas the following show a predilection for the other sex: anemic conditions, lupus erythematosus, osteomalacia (thirty to one), goiter (simple and exophthalmic), myxedema, and chorea.

Nationality.—This may determine immunity or susceptibility. The Japanese show a comparative immunity to scarlet fever, the Chinese to cholera, and the negro to malaria and yellow fever. Exanthemata that may be mild among the civilized, show great malignancy among savages. The Jew is predisposed to diabetes and nervous diseases, and shows greater immunity against tuberculosis and infectious diseases. Races accustomed to primitive methods of living, when brought under the influence of civilization fall ready victims to tuberculosis.

Occupation.—Here an unhygienic environment plays the chief rôle. An atmosphere laden with dust, especially irritating dust, conduces to phthisis, which is frequent among grinders, polishers, stone-cutters, and miners. Players of wind-instruments are subject to emphysema; grain-handlers to actinomycosis; skin-handlers to anthrax; hostlers to glanders and tetanus; butchers to septic infection; electric-light workers to conjunctivitis, etc. Then there are the *occupational intoxications:* lead, antimony, and arsenic poisoning among smelters, potters, lead-burners, and file-makers; mercurialism in those brought in contact with mercury in certain of the arts. Brass workers may suffer from anemia, cardiac and gastric symptoms, with progressive emaciation, and a green line may be seen on the gums. Founders' ague in brass foundries is supposedly due to chromium and zinc poisoning. Phosphorus poisoning occurs among match-makers; arsenical poisoning among aeronauts, owing to the use of impure hydrogen for inflating balloons; potassium cyanid poisoning among photographers, etc. Then there are the *occupational neuroses* associated with great mental effort, and common among professional people: neurasthenia, hysteria, and paralytic dementia. Like neuroses are frequent among those who make excessive use of the hands: the cramps of writers, telegraphists, compositors, tailors, milkers, etc. A similar condition follows employment of the lower extremities among dancers, organists, treadlers, sewing-machine operatives, etc. The isolated rural life predisposes to insanity, whereas the active urban life conduces to neurasthenia. Close observation will frequently enable one to make what I am pleased to call *occupational diagnoses*. Long-continued horseback-riding conduces to poorly developed bowed legs, with a tendency to "toe-in" in walking. Long-continued standing predisposes to varicose veins and ulcers. An incurvation of the lower thorax is found in shoemakers. Those who employ one hand excessively, like carpenters and blacksmiths, present a lateral spinal curvature. Violinists show a lateral inclination of the head. *Callosities* in definite situations betray the occupation: upon the tips of the fingers of the left hand in players on string instruments; upon three fingers of drummers; on the entire internal hand of laundresses; on the palm and fingers of the right hand in shoemakers; on the left hand, on the palm, index-fingers, and thenar eminence in locksmiths; over the five metatarsal bones externally in tailors. Callosities over the lower end of the sternum occur in wheelwrights, over the surface of the left thigh in shoemakers, and over the ischial region in equestrians.

Previous residence is important. In the southern portion of the United States the following diseases are endemic: ainhum (negro), dengue, filariasis, intermittent and remittent fevers, leprosy and yellow fever. In tropical regions we have dysentery (epidemic), hepatic abscess, hepatitis, intermittent and remittent fevers, leprosy, and filariasis. Certain diseases are peculiar to definite countries, ranging all the way from the guinea-worm disease and dengue of Africa to goiter and cretinism in Switzerland. *Habits* are prominently concerned in etiology. They refer to diet, use of intoxicants (alcohol, tea, coffee, tobacco), sexual life, etc.

Previous diseases predispose or confer immunity. Among the former are: appendicitis, apoplexy, angina pectoris, asthma, bronchitis, delirium tremens, diphtheria, epilepsy, erysipelas, gout, lead intoxication (colic), malaria, migraine, nephritis, neuralgia, pneumonia, renal colic, rheumatism, and tonsillitis. The frequency of relapse in appendicitis varies from 20 to 44 per cent., and in pneumonia it is about 30 per cent. A second attack of the following is infrequent: measles, mumps, pertussis, scarlatina, typhus and typhoid fever, variola, varioloid, varicella, and yellow fever.

Previous diseases are also identified with their *sequelæ:*

1. *Syphilis*, with chronic and bizarre skin eruptions, arteriosclerosis, and nervous diseases (tabes and paralytic dementia).

2. *Gonorrhea*, in atypic affections of the joints, tendons, muscles, of a rheumatic nature, orchitis, stricture, and pelvic affections.

3. *Scarlet fever*, in middle-ear affections, nephritis, and rheumatism.

4. *Rheumatism*, in tonsillitis, chorea, valvular, cardiac, and renal lesions.

5. *Tonsillitis*, in rheumatism and cervical lymphadenitis.

6. *Liver abscess*, in dysentery and infection which may have reached the liver by way of the portal vein.

7. *Traumatism*, injury in the hepatic region can be followed by abscess of the liver. A blow on the stomach has been followed by cancer of the organ. Bleeding from any part of the urinary passages may be produced by injuries. Pneumonia (contusion-pneumonia) may follow a chest injury without necessarily any lung injury. Blows to the chest, head, and knee have been followed by pulmonary, meningeal, and joint tuberculosis. In such instances the trauma acts by exciting the tubercle bacilli, which may be pres-

ent, but are dormant, to increased activity. Then we have the traumatic neuroses, which may be manifested as a neurasthenia or hysteria, or they may show symptoms suggesting organic disease of the nervous system.

There are many diseases which, owing to their infrequency, demand excessive caution in diagnosis. It is a good rule to remember that when the symptoms present correspond with two different diseases, it is safe to conclude that the more common disease exists.

Seasonal Prevalence of Disease.—In pneumonia the highest incidence of the disease is in the winter and spring months; notably, February and March. Diarrheal diseases predominate in summer; rheumatic affections in winter and early spring; typhoid fever in autumn—hence the popular name, "autumnal fever"; influenza, while usually independent of seasonal conditions, is most severe during the colder seasons; malaria, in temperate regions (Atlantic States), predominates in September and October; hay-fever has been divided into the "June" or "rose" cold, prevalent in the spring, and hay-asthma or hay-fever, occurring in August and September. One-half of all cases of erysipelas, according to Anders, occur from February to June, and 15.9 per cent. during April alone. The greatest number of cases occur when the barometer is low with mean relative humidity.

Diurnal Exacerbation of Disease.—Insomuch as the temperature in various diseases attains its maximum between the hours of 7 and 8 P. M., it is quite evident that such affections are aggravated at this particular time. The dyspnea of asthma and various cardiopulmonary affections is usually worse at night. That the pains of syphilitics are intensified at night is doubtful, for the reason that all pains are aggravated at a time when the senses are unoccupied and the patient wholly resigns himself to introspection. Incontinence of urine at night has often directed attention to unsuspected epilepsy, especially if the patient awakes with headache, mental confusion, and a bitten tongue.

Periodicity.—The belief was common that all diseases recurring with a definite periodicity were malarial, but there are a host of diseases in which malaria can be excluded which show this peculiarity: viz., bronchial asthma, neuralgias, relapsing fever, epilepsy, pseudo-angina, periodic paralysis, menstrual anomalies, etc.

Atmospheric Pressure.—As a factor in the etiology of disease this is exemplified in the so-called *barometric neuroses.* Electric storms produce headaches. Positive atmospheric electricity stimulates, and the negative variety present in inclement weather depresses the individual. Increased atmospheric pressure is important with relation to the etiology of those working in caissons (caisson disease) and divers. Here the notable symptoms are bleeding from the nose, ears, and mucous membranes, delirium and paralysis. Decreased atmospheric pressure occurring in high altitudes produces a train of symptoms known as "mountain sickness": viz., salivation, nausea, vomiting, diarrhea, vertigo, headache, apathy, and somnolence. The respirations and pulse are accelerated.

Simulation or Dissimulation on the Part of the Patient.—To assume that simulation on the part of the patient has been mastered by our methods of diagnosis is an illusion, for it would be tantamount to an admission that we have mastered the psychology of disease. Hysteria is *facile princeps* the paragon of simulation. Its characteristic stigma is auto-suggestibility. It affects males as well as females, and children as well as adults. The mental state is one constantly on the border-line of sanity and insanity. It plays the most capricious pranks with every function of the body, ranging all the way from hysterical hyperpyrexia to hysterical pseudo-phthisis. Let us not even for a moment assume that it stands alone in its majesty, completely isolated from other diseases; on the contrary, it is a mental phenomenon, not less morbid nor common than fever or any other somatic evidence of disease. It permeates in various dilutions every pathologic picture, and no morbid tableau is complete without it. Thus, there is such a disease as hysteria and there are hysteroid diseases. We will have occasion later to discuss this subject.

Many patients practise deception by failing to take their medicine. The addition of several grains of potassium iodid to the prescription will prove the deception. The iodin can be easily demonstrated by obtaining a drop of saliva on a piece of starched fabric, which, upon the addition of a drop of nitric acid turns blue.

An old-time physician in San Francisco whose hobby was dietetics was in the habit of giving an emetic without warning to patients whom he suspected of disobeying his directions and thus brought to light the offending aliment.

II. TREATMENT.

One must not assume that a good diagnostician is necessarily a good physician; on the contrary, the reverse is often true. A successful physician, however, must be skilled in diagnosis. Diagnosis is scientific, and it is commendable, but it must not usurp the province of common sense; for, after all, the aim of all medical service is the healing of the sick. "More than ever now," says Hinton, "the physician must have knowledge of the soul; must feel with finer senses, other pulses; and measure heats and chills, which no thermometer can gauge! Each year's progress in science gives new strength to this position and defines with increasing accuracy the place of the physician in advance of the dry and soulless philosophy which is too generally accepted as scientific medicine." With our scientific proclivities and a test-tube as the analogue of our patient, are we drifting back to the Skodaic pessimism, when Skoda proclaimed his contempt for treatment as follows: "We can diagnose disease, describe it, and get a grasp of it, but we dare not by any means expect to cure it." From the same school of therapeutic nihilism, we recall Hebra, who said that ten thousand cases were required before a therapeutic opinion could be justly formed. Conservative medicine is too often a practice of trusting to nature and confirming the diagnosis at the autopsy. Drugs are mere incidents in the treatment of the sick. Medical practice is more than a discovery of facts: it is the practice of intelligent sympathy, the creation of inspiration and the inoculation of hope. I do not mean the maudlin sympathy, the stuff that accentuates the psychic factor in disease.

The average patient is not so much concerned about what he has, as by what he thinks he has. "The patient is seldom right; in imaginary diseases he believes too much, in real diseases he does not believe enough." We must not forget the Hippocratic allusion to medical art: "That it consists of three things—the patient, his malady, and the physician." Several medical aphorisms of A. J. Borne-Volber possess so much condensed wisdom that they will bear repetition:

1. Everything that promotes the general health promotes recovery from the particular disease.
2. All that influences health, influences disease.
3. The basis of pathology is physiology; that of therapeutics is hygiene.
4. When a patient is cured, remove him from his former surroundings.
5. Prolonged chronicity is no less to be feared than a relapse.
6. The further the physician and the patient drift from nature, the more difficult it is to cure.
7. The milder the régime has been, the greater the physician's resources.
8. The patient wishes not only to be cured, but to be treated; his luxury is the importance of the physician and his remedies.

The Psychology of the Patient.—One must not stake anything on the mental status of the average patient. In the presence of his patient, the physician is compelled to rise above the melancholy of his environment. The witty paradox of Moxon is apposite: "It is quite as important to know what kind of a patient the disease has got, as to know what sort of disease the patient has got." Two diagnoses are therefore imperative—the disease and the patient. Disease is demoralizing, and merits the Johnsonese observation, "Every man is a rascal as soon as he is sick." Louis XIV suffered from a fistula, and his reign was said to have been divided into two parts—that before and that after the fistula. The psychologic phenomena of disease are varied. They are dependent on disturbed nutrition of the higher cerebral centers and on the action of toxins on the neurons. Such action is modified by the mental, moral, and physical organization of the individual. The action of toxins in disease has been appositely compared to the effects of alcohol. Chemically, the action of alcohol on the nerve-cells is always the same, but the individual's temperament, resistance, and moral status must be considered. Thus the picture of the mental reaction to alcohol is varied; some become morose and inactive, others excited and quarrelsome, and still others show an exalted state of well-being. That chemicals influence thought we have no reason to deny when one recalls the action of chloroform, morphin, atropin, cocain, cannabis indica, etc.[2] In the body alkaloids are being constantly manufactured which can duplicate the action of many of our well-known drugs. Such alkaloids are mainly derived from ingested foods. The neoplatonist, Porphyry, wrote, "It is not among the eaters of simple vegetable foods, but among the eaters of flesh that one meets assassins, tyrants, and robbers." If the psychology of the patient is influenced by food in health, it is evident that in disease the same influence is accentuated. Schofield[3] tells of a physician who once said to him, "If a man is so ill as to say he is ill when he is not ill, he must be very ill indeed." "No one," avers Lavénge, "can be a hypochondriac at pleasure." The observation of the older clinicians still bears the imprint of truth: viz., that the mental condition of patients is more cheerful in diseases above than below the diaphragm. Contrast the dyspeptic in the slough of despond with the consumptive, in whom "hope springs eternal in the human breast."

The Psychic Factor in Treatment.—The judicious physician skilfully combines pyschics and physics, and the unsuccessful physician is he who uses one to the exclusion of the other. The rational mind-cure, like all things rational, is limited in its scope. It is only one of many methods for effecting cure. It does not undertake to do the impossible nor to supplant legitimate methods aiming at the same object. The patent medicine advertiser understands the financial value of his almanac, which suggests an infinite variety of pains, and his repeated positive assertions about the efficacy of his medicines inspire belief, just like the liar, who soon becomes convinced of the reality of his own prevarications. There are three degrees of liar—prevaricator, liar, and, superlatively, the patent medicine advertiser.

One is constrained to admit that the potency of suggestion is determined not so much by the suggestion *per se*, but by the person who manipulates the suggestion. Thus the ignoramus is often able to compete with the scientific physician in so-called mind-cures. With a fertile mental soil for humbuggery, truth can never successfully compete with untruth; hence the prestige of the mental healer. We must carefully avoid having our therapeutic methods referred to as a "meditation on death," as Asclepiades said of the Hippocratic treatise on therapeutics. "To obviate the tendency to death," as the old therapeutists put it, can be made the object of intelligent effort. Molière, the most trenchant of satirists in customs medical, asserted that the authorities of his time exacted an oath from medical candidates that they would never alter the practice of physic.

Medicine embraces more than "a theorem of investigation by the senses," and disease can often be combated even without the aid of ultra-scientific methods, provided intelligent individual interpretation is employed. The mind which inhabits the body operates powerfully in health and disease with its strong passions and vivid imaginations. The mind creates pictures equally as varied as the kaleidoscope: hence the mind must be studied to find a picture that will regenerate the patient. "It is easier to understand the cause of diseases than of recoveries; hence the prestige of medicines." There are more false facts than theories. Quacks live and fatten on what the legitimate physician wastes. The quack recognizes the psychologic aspect of disease, which some physicians studiously ignore. The therapeutics of the imagination, or the force of mind over body, is the real secret of quackery. All faith cures can be accounted for by the effects of the mind upon the body. The suggestion of cure is primarily conveyed to the subject by the operator, and his method is a mere vehicle for such suggestion. The reaction is the idea of cure, in accordance with the law that every idea, if left to itself, will generate its actuality. The idea of cure is emphasized by previous conviction or the positive assurances of the operator.

Normal suggestion has always been employed by the physician for the cure of disease, perhaps not with the assiduity which it truly deserves, for psycho-therapeutics must now be regarded as an integral part of medical practice. Heretofore the physician employed suggestion as a mere dilettante, his conservatism prompting him to eschew a practice which might jeopardize his professional reputation, or would perchance effect some moral or mental injury to the patient. Skepticism is as bad as credulity, for the former is "reason without belief, and the latter belief without reason." We are constrained to accept facts whether they represent mind or matter, and if one is compelled to recognize a mental factor in the cure of disease, it must not be entrusted to an unlettered, small-knowing soul, but employed by the physician who is skilled in the diagnosis of mental and physical diseases. When the psychic factor in treatment is accorded due consideration, it is not difficult to understand why one physician's calomel differs from that of another physician. Suggestion plays an important rôle in most of our therapeutic methods. I had occasion to prescribe a purgative and hypnotic for a patient. He was an inveterate sufferer from insomnia, and, at the time, no sleep had been obtained for three nights. At my next visit I was informed that "he had slept splendidly," a fact which was rather surprising, when I discovered that he had, by mistake, taken the purgative as a hypnotic. I did not disabuse his mind, and even now, after the lapse of fifteen years, he continues to obtain the same effect from the supposed sleeping medicine, the purgative, after each administration. Roberts Bartholow observes: "He who despises his art can never become a great artist. Good practitioners are always found to be men entertaining the greatest confidence in the powers of medicines."

The Ethics of Untruth.—The physician is often constrained to give deceptive answers for the good of the patient. It is rarely necessary to deceive the patient, but it is not always necessary to undeceive him. A lie, as a French wit said, should be kept for great occasions: it is too good a thing to be wasted. It may be necessary in chronic diseases to tell the patient the nature of his ailment to solicit his intelligent co-operation in treatment, yet one must recall what Pindar says of hope, which, "more than aught else steers the capricious will of mortal man." Coleridge said, "In nerve disease he is the best physician who knows best how to inspire hope." There are those who believe that any departure from absolute truth is wrong, even though the object be the saving of the whole race, and there are those who agree with Paulsen: "There is not a physician in the world who does not give deceptive answers to his patients, who does not excite hopes that he does not share. He does not blame himself, nor do others, for every one does the same." It is the frank brutality of the scientific practitioner which encourages "scientific (?) mind-healers." Johnson observed, "You have no business with consequences; you are to tell the truth." Dock,[4] commenting on the foregoing, notes a serious flaw in Johnson's logic, inasmuch as the chief interest of the physician is with the consequences, and if he thinks the patient can only gain by misinterpretation, it is just as proper for him to use it as it would be to give a medicine that in other cases might be quite improper.

The Technic of Prescribing.—One cannot ascribe too much importance to the following: "Treat the condition, not names; the man, not the disease." "Successful treatment," said Hufeland, "requires one-third science and two-thirds *savoir-faire.*" Radcliffe asserted that as a young practitioner he possessed twenty remedies for every disease, but at the close of his career he had found twenty diseases for which he had not one remedy. A physician is known by the prescription he writes. "It should be written with a pen of iron and with the point of a diamond." A physician has been defined as one who spends his life in writing death sentences in Latin. Few of us can arrogate to ourselves so much erudition. Latinizing a prescription correctly is a monument to our predecessors. Voltaire said that doctors were people who pour drugs of which they know little, into a body of which they know less. If we must dose, let us do so with discretion. "For a sonnet to Amanda and the like, stewed prunes only might be sufficient; but for a great design, nothing less than a more formal and more formidable dose." Some patients require vile drugs which in action are like what David Harum said about dogs: "They say a reasonable amount of fleas is good for a dog—keeps him from brooding over being a dog." You cannot satisfy some unless you give them "the rankest compound of villainous smell that ever offended nostril." Physicians never take their own medicine, but they ought to—it would make them more considerate for the feelings of others. The old rule in giving medicines was "*curare, cito, tute, et jucunde,*" *i. e.,* to cure, to do so quickly, safely and pleasantly. Above all, in giving medicines recall the German motto, "*Nur nicht schaden*" ("only do no harm"). Others require the most elegant pharmaceutic products, which conciliate the eye and palate and are beyond offending the alimentary canal. The foregoing facts are only applicable in *placebo medication*, otherwise we will discredit therapeutics, which is an art worthy of the most careful consideration. Many species of the prescription-writer can be differentiated, but we will content ourselves with a description of the commoner varieties.

The Prescriber of Proprietaries.—Here is one who accepts with avidity every new preparation foisted on a credulous profession by the designing manufacturer. The number of new preparations forced on the medical profession is legion. The bewildered physician is instructed to use "Browne's emulsion of cod-liver oil," because the molecules of oil are in a finer state of division by $\frac{1}{100}$ of an inch than was the preparation of "Jones"; that "the bad taste of Green's elixir of quinin remains in the mouth after taking for two minutes' less time than any other elixir of the same preparation." Smith provides an expectorating cup with his cough medicine; Thomas presents any physician prescribing his insuperable aphrodisiac with a set of antiseptic shirt studs; Jackson's antirheumatic is made by a joint stock company, etc. If this comedy continues, a prescription of the future will read as follows:

℞. Extracti gall-æ (Gray's)	3 oz.
Acidi gall-ici (Brown's)	1 oz.
Olei gaul-theriæ (White's)	1 oz.
Aquæ (Black's)	gall on.

Mix with Green's universal pestle in Indigo's patent riveted, copper-lined mortar, at a pressure of five pounds and three-quarters, as determined by Lavender's poundometer; then filter through filtering paper imported by Garnet and Co., No. 116 Alimentary Way, near the Island of Reil, on the Isthmus of Fauces in the State of Diathesis.

Dr. Sempervirent.

To select judiciously from old drugs is equal to discovering new ones. Some one has said that new remedies are invented every day, chiefly for the benefit of those who do not understand the use of old ones. I do not by any means deprecate the practice of prescribing new drugs when they have been found to be endowed with special properties. The local anesthetic action of cocain was discovered by Koller in 1884, yet it was not until 1894 that it became official. I do, however, protest against the employment of preparations the ingredients and quantities of which are either unknown or only partially known. The master in therapeutics uses but few drugs, but he knows how to use them. He can make his ipecac perform its duty as an expectorant, emetic, and anti-emetic. Being fully conversant with opium and its alkaloids, he can so manipulate them as to attain any therapeutic result peculiar to these preparations. Our aim is to make therapeutics scientific, but we must not eschew empirical treatment because it is founded on experience, for mercury is a product of empiricism only.

The Polypharmacist.—This one is closely related to the former. His conception of medical practice is to prescribe internally, externally, and eternally. His "shotgun" prescription is as much a contradiction as the "whisky cocktail" described by the perturbed Frenchman: "A little whisky to make it strong, a little water to make it weak, a little lemon to make it sour, a little sugar to make it sweet, and then you say, 'Here's to you,' and you drink it yourself." The polypharmacist is necessarily endowed with infinite humor and his victim with unbounded faith; thoughts of physiologic and chemic incompatibility do not mar his serenity, and his prescription goes forth to act on a multitude of organs in a multitude of ways, with naught else but Fate to guide its destiny.

The Monopharmacist.—This is the type of the scientific therapeutist. He uses one drug so that he may be able to follow its physiologic and consequently its therapeutic action. He knows that if the former is not obtained he cannot expect the latter. He knows when to avoid the toxic action of the drug. Now, digitalis in therapeutic doses slows the pulse and raises the blood-pressure, but in toxic doses the contrary effects are provoked. The monopharmacist knows that a small dose of atropin will slow and that a large dose will accelerate the pulse. He knows that, as a rule, small doses of a drug usually stimulate and large doses paralyze. Aside from its great scientific importance, monopharmacy has also its suggestive side. I once had occasion to question a charlatan respecting the ingredients of a popular medicine which he sold. He answered that the main ingredient was a purgative which achieved a dual object: first, most people were satisfied if they had a daily bowel movement; second, such a drug demonstrated a physiologic action which most people could appreciate. I know a physician who uses only one drug in his prescriptions. He only uses drugs which have a definite physiologic action. He acquaints his patients in advance respecting the sensations which will be experienced, and the patient having experienced them, fully believes in his physician thereafter. This is somewhat in accord with the practice of Dr. Rush, who never prescribed remedies until he had educated his patients with the confidence of certainty concerning the effects of the medicines. It was Sydenham's custom when consulted by the patient for the first time to say: "Well, I will consider your case and in a few days will order something."

Certain drugs have a specific action on the special senses. Strychnin renders the sight more acute and enlarges the field of vision for blue. To produce these effects on vision a dose of 2 to 3 mg. is required. A similar action may result by applying a 1 per cent. solution to the cornea. The cerebral centers for hearing are stimulated by quinin and the salicylates. The sense of smell is made keener by strychnin, and it is claimed that disagreeable scents are experienced as agreeable ones. Certain drugs paralyze the sense of taste. If one chews the leaf of a plant called *gymnema sylvestris*, one cannot distinguish bitter and sweet; but it does not destroy acid nor salt. Yerba Santa destroys a bitter taste, but is without influence on sweet, salt, or acid. One cannot disregard *perfume* in therapeutics. In susceptible individuals certain odors will excite the nervous and respiratory apparatus, and reflex digestive disturbances (nausea and vomiting) are not infrequent. The odors from certain flowers will provoke asthmatic paroxysms. Severe faintness occurs in certain persons when they enter a room in which there are tuberoses. Headache may follow inhalation of the odors derived from the lily, rose of Sharon, or carnation. It is a popular belief that the odors from manure are specific in rheumatism. The odor of musk is said to augment the sexual appetite. The odors of vanilla and heliotrope are said to quiet the nervous system.

The Individual Prescriber.—This one prescribes for the patient as well as his disease. His prescription is rarely a misfit because it is custom-made. The prescription of the French physician not only embodies the medicament, but likewise dietetic rules and other methods to be followed by the patient; in other words, he gives his patients written in lieu of oral instructions. If a bath is prescribed, even the most trivial details are written. It would be wise for us to emulate this custom, for instructions to the average patient go into one ear and out of the other—there is nothing between the ears to retain them. Such general directions of recommending another climate without detailing the specific attributes of the climate to be sought, recalls the story of the physician who was once called in by a gentleman who had a very sick mother-in-law. After examination of the patient, the physician called the gentleman aside and said: "Well, the only thing I can suggest is that you send your mother-in-law to a warmer climate." The man disappeared, and came back with an ax a moment later and exclaimed: "Here, doctor, you kill her; I really haven't the heart."

One could cite other types of the prescribing physician, notably the symptomatic prescriber. In many instances, symptomatic is nearly as important as causal treatment, viz., reduction of temperature, relief of pain, arrest of hemorrhage, etc.

Purity of Drugs.—Drugs are to the physician what good tools are to the artisan. Many drugs have been discredited owing to inert preparations. Drugs become innocuous by age. I once sought for digitalis in various stores, and it was only after the tenth attempt that I was able to secure a reliable product. Ergot and a host of other preparations prove untrustworthy because they are derived from unreliable sources. The "ready to use" pills of the manufacturer often have a safe passage, and many stirring stories could be indited on the adventures of these innocuous bullets. Tablets often prove unreliable in dosage, constituents, and solubility. The commercial sodium salicylate is now obtained by various processes, the result being that many preparations on the market prove unreliable. The newer synthetic drugs are being introduced to the profession with such rapidity that their ephemeral existence proves their unreliability. In the choice between the old and new remedies the former should always be chosen, because they have a definite and known composition and have been tested by years of clinical experience.

Habit and Idiosyncrasy.—The physician dare not disdain the habits and peculiarities of his patients. The so-called "constitution" of the patient is no myth, and I know of many instances where the physician's disregard of the patient's observation "that certain drugs disagreed" was followed by unfortunate results.

Less than a grain of calomel has induced ptyalism. Others show susceptibility to opium, mercury, ipecacuanha, quinin, and the iodids. Before prescribing any of the foregoing it is better to ask if they have ever been taken, and, if not, cautiously employ them in the beginning. In defective kidney-elimination, as in nephritis, opium and mercury must be used with caution.

The greater the development of the central nervous system, the more pronounced will be the cerebral action of drugs. Alcohol produces less intoxication in fever. Tolerance to a drug may be established by repeated administration, owing probably to the production of anti-bodies (toxins).

Dose.—This is modified by sex, weight, and age. The dose for a woman is about four-fifths of that for a man. The heavier the individual, as a rule, the larger the dosage. For children, the dose is estimated either according to Young's or Cowling's rule.

Young's Rule: Convert the child's age into a fraction by using the age itself as a numerator, and the age and 12 as a denominator, the result being the proportion of the adult dose which should be given to the child. Thus, for a child of three years: $\frac{3}{3+12} = \frac{3}{15} = \frac{1}{5}$ of that of the adult. At the age of twenty-one, the full dose is given.

Cowling's Rule: Divide age of child at its next birthday by 24. Thus, for a child of three years the dose would be $\frac{4}{24} = \frac{1}{6}$ of the adult dose.

Brunton's Rule: This is calculated for the metric system. Multiply the full dose by the child's next birthday, then by 4, and remove the decimal point two places to the left Thus, if the dose for an adult be 1 gm., that for a child of three years will be $\frac{1 \times 4 \times 4}{100} = 0.16$ gm.

The following drugs are taken in relatively larger doses by children: belladonna, arsenic, chloral hydrate, potassium bromid, and mercury. Opium, however, must be given with caution.

COMPARATIVE TABLE OF WEIGHTS AND MEASURES.

gm. = gram.
c.c. = cubic centimeter.

1 gm. = 15.432 grains.
0.1 gm. = 1 decigram = 1.5432 grains (about 1½ grains).
0.01 gm. = 1 centigram = 0.15432 grain (about $\frac{1}{6}$ of a grain).
0.001 gm. = 1 milligram = 0.015432 grain (about $\frac{1}{60}$ of a grain).

1 c. c. = 16.9 minims.
3.54 c. c. = 1 fluidram.
28.35 c. c. = 1 fluidounce.

Grains.		Grams.	Grains.		Grams.
$\frac{1}{100}$	=	0.0006	$\frac{1}{2}$	=	0.032
$\frac{1}{50}$	=	0.0013	$\frac{3}{4}$	=	0.049
$\frac{1}{25}$	=	0.0027	1	=	0.065
$\frac{1}{8}$	=	0.008	3	=	0.194
$\frac{1}{4}$	=	0.016	5	=	0.324
			10	=	0.648

Approximately, ♏j = 0.06 gm.
fʒj = 4 gm.
f℥j = 32 gm.

List of Conventional Drugs Which Are Chemically Incompatible.—*Alkalies* (carbonates and hydrates) precipitate all alkaloids (*e. g.*, morphin muriate) and metallic salts.

Alkaloidal salts (morphin mur., atropin. sulph.) are precipitated by alkalies, tannin, free iodin, and mercurial salts.

Antipyrin should always be prescribed alone.

Chloral hydrate must not be prescribed with alkalies, alcohol, and strong solutions of antipyrin.

Chromic acid and *potassium permanganate* destroy all organic compounds.

Digitalis must not be given with iodin, tannin, and salts of iron.

Iodin and iodids yield precipitates with the alkaloids. Organic preparations of iodin (iodipin, iodoform, etc.) must not be given with potassium permanganate, silver nitrate, or sublimate.

Iron salts are incompatible with tannin, salts of iodin, salicylic acid, and alkalies.

Magnesium salts are precipitated by alkalies.

Morphin muriate with salts of silver and mercury, alkalies, and tannin.

Mercurial salts are precipitated by tannin and alkalies, and they are further changed by many organic compounds.

Salicylic acid is altered by the salts of iron.

Sodium biborate precipitates morphin and salts of cocain; the addition, however, of a small quantity of boric acid prevents precipitation.

TABLE OF NOTABLE MUTUALLY PRECIPITANT SOLUTIONS.—(*Curtis.*)

	Solutions of Alkalies.	Carbonic Acid and Solutions of Carbonates.	Sulphuric Acid and Solutions of Sulphates.	Phosphoric Acid and Solutions of Phosphates.	Boric Acid and Solutions of Borates.	Hydrochloric Acid and Solutions of Chlorids.	Hydrobromic Acid and Solutions of Bromids.	Hydriodic Acid and Solutions of Iodids.	Solutions of Sulphids.	Tannic Acid.	Arsenical Solutions.	Albumin.
Alkaloidal solutions (generally).......	Prec.	Prec.	..	Prec.	Prec.	..	..	Prec.	..	Prec.	..	..
Metallic solutions (generally).......	Prec.	Prec.	..	Prec.	Prec.	..	..	..	Prec.	Prec.	Prec.	Prec.
Lead solutions......	Prec.	Prec.	Prec.	Prec.	Prec.	Prec.	Prec.	Prec.	Prec.	Prec.	Prec.	Prec.
Silver solutions.....	Prec.	Prec.	Prec.	Prec.	Prec.	Prec.	Prec.	Prec.	Prec.	Prec.	Prec.	Prec.
Calcic solutions	Prec.	Prec.	Prec.	Prec.	..	..	..	..	..	..	..	..
Magnesic solutions .	Prec.	Prec.	..	Prec.	..	..	..	..	..	..	..	..
Albuminous solutions............	..	..	..	..	..	..	..	..	..	Prec.	..	..
Gelatinous solutions	..	..	..	..	..	..	..	..	..	Prec.	..	..

CHAPTER II.

I. THE INTERFERING ACTION OF DRUGS IN DIAGNOSIS. II. DRUGS IN THE ETIOLOGY OF DISEASE. III. FOOD IN THE ETIOLOGY OF DISEASE. IV. METHODS OTHER THAN DRUG-GIVING IN THE ETIOLOGY OF DISEASE.

I. INTERFERING ACTION OF DRUGS IN DIAGNOSIS.

A cardinal principle in therapeutic practice is, "To find out what will harm the patient, and then not give it." The essential object of diagnosis, from a therapeutic standpoint, is not only to furnish an outline of treatment, but to know what not to do in a given instance. In the art of treatment we have as much to unlearn as to learn. Meddlesome therapy is bad. Many drugs have been discovered for the patient and the physician; to relieve the former of obeying the laws of hygiene and the latter of inculcating them. A Frenchman in commenting on new remedies made the pertinent observation to the medical profession: "Hurry and take it while it still cures, for soon it will be found to prove of no value." It is related of a celebrated London physician that, being called in consultation in a case of acute articular rheumatism, he detected a pericardial murmur, which the physician in attendance had overlooked. The latter expressed contrition for his negligence, but the consultant assured him, "It was well he had not detected it; he might have treated it." Now, in all likelihood, the attending physician would have applied a *blister* to the precordium in lieu of placebo medication, in the event something had to be done. Cupping and leeching or an ice-bag would have done, theoretically at least, the same service as the blister. The blister would have retarded diagnosis, insomuch as the physical signs so necessary in following an acute fibrinous pericarditis to effusion could only have been used with difficulty owing to the pain associated with their application. Presuming that a blister were really necessary, the astute physician would have used a small one and applied it well outside the precordium, so that there could be no interference with percussion and auscultation. One also knows that a blister directly over the pericardium (or for that matter applied over any inflammatory area) may accentuate the pericarditis. The application of the blister to the abdomen, chest, joints, and elsewhere for like reasons interferes with diagnosis and prevents a proper knowledge of the progress of the case. *Potassium iodid* causes catarrhal symptoms of the respiratory tract, hence a suspicious lung lesion may really be due to the action of this drug (*vide* this drug in diagnosis). Many *skin lesions* are often so modified by the irritant action of drugs that we are often unable to differentiate between the original and accessory lesions. The conventional method of treating *Boils* with fomentations or poultices leads to a dissemination of infection and the recurrence of new boils. *Calomel*, applied externally to mucous membranes, or taken internally while the subject is under the influence of potassium iodid, may cause intense irritation, which is especially the case in ocular troubles. The latter, originally non-inflammatory, may become inflammatory. Here the iodid eliminated in the secretions forms with mercurous compounds an irritant mercuric iodid.

Diagnosis is further hampered by injudicious medication in *syphilis* when treatment is begun at the time of the equivocal initial lesion. There is reason to hope that the *spirochæta pallida* may be absolute in the diagnosis of the primary lesion, but until then it is decidedly wrong to commence antisyphilitic treatment with no other evidence of syphilis than a solution of continuity on the penis. The indiscriminate application of caustics to sores on the genitalia may cause a reactive induration and thus obscure the diagnosis of primary sclerosis which is so characteristic of a chancre and indurate a soft sore which is not ordinarily indurated. In the present state of our knowledge the existence of syphilis is assured only when the secondary symptoms have appeared (roseola, specific angina, alopecia, mouth lesions, etc.). Early antisyphilitic medication can prevent secondary symptoms, and for that reason one remains in doubt whether the penile lesion was or was not syphilitic. In such instances the unfortunate either is destined to submit to unnecessary treatment over a tedious period of time or to have no treatment at all. Some assert that the character of the secondary eruption is useful in prognosis: an erythematous eruption indicates a light, and an early pustular eruption a severe case with serious complications. The application of strong irritants to *Leukoplakia* has often conduced to the development of cancer. Again, buccal leukoplakia may be the only evidence of syphilis, and local applications may obscure the diagnosis, provided local is employed in lieu of general treatment.

Attempts to inhibit *albuminuria* (a symptom) deprive one of an important index of the progress of the renal disease. The loss of albumin is always unimportant and can easily be supplanted by the whites of a few eggs a day.

Antipyretic treatment begun unnecessarily early may deprive us of the diagnostic advantages of the thermometric curve. The type of the fever, continuous, remittent, or intermittent, may in consequence be undetermined. Take typhoid fever. Here the gradual step-like ascent and the maintenance and slow descent make a temperature curve that is characteristic. Without this curve, complications may remain unrecognized, as the sudden fall in temperature in intestinal bleeding or perforation. The diagnosis of other pyrexial diseases is similarly influenced. Is reduction of temperature of real therapeutic value in disease? To answer this question, the significance of fever must be determined. The views concerning fever are conflicting. Some contend that elevation of temperature is dangerous; others hold that the infectious process depends to a moderate degree only on the temperature; and still others that the high temperature is salutary, for by this means the infected body is "cleansed by fire."

Neither clinical studies nor statistics have solved this momentous problem. There is much reason to believe that fever is a salutary process. A sudden fall of temperature during an infection is unfavorable, for it may augur a collapse. Non-resistant individuals often show a feeble pyrexial reaction to infection. For instance, the mortality in pneumonia in old persons and drunkards is very high, and in such individuals the temperature range is lower than in healthy individuals. The feeble pyrexial reaction in such instances is somewhat akin to the absence of leukocytosis, which is likewise regarded as an unfavorable sign. Lenhartz maintains that pathogenic bacteria thrive best at the normal temperature of the body, and that they either die or lose their toxic properties with the commencement of fever. The micro-organisms of malignant pustule cannot live at a temperature above 104° F., and thus cannot infect birds, whose normal heat exceeds this limit. Pasteur demonstrated that this immunity could be destroyed if the temperature of a bird were reduced artificially.

I have frequently employed very hot baths with favorable results for the purpose of raising the body-temperature in infectious diseases where there was little or no febrile reaction. By means of radiant heat the body-temperature may be raised several degrees. The sequaciousness of the physician is proverbial. He has been taught the life-saving functions of antipyretic treatment in typhoid fever by systematic hydrotherapy. Now, no therapeutic method is universal in its application, and individualization is as imperative in typhoid fever as in other diseases. Antipyresis by hydrotherapy is often inimical to cardiac vigor; by the use of drugs it is always so. There are many theories in explanation of the salutary effects of cold water in typhoid fever, and that which commends itself most to reason is the theory which supposes that they are achieved by stimulation of the peripheral cutaneous nerves, which influence reflexly the nerve-centers presiding over the functions of respiration, circulation, nutrition, and excretion. Until we are willing to dismiss antipyresis as the great desideratum in the treatment of the acute infectious diseases, we cannot hope to achieve any better results than are at present obtained. Stimulation reflexly of the great nerve-centers is the chief object to be obtained in pneumonia, typhoid fever, and other infections; for maintenance of the circulatory and respiratory apparatus is of greater importance than the reduction of a few degrees of temperature. To secure this cutaneous stimulation, I make systematic use of *carbonated baths* in the acute infections, repeating the baths twice or thrice daily whenever the pulse indicates cardiac enfeeblement or the sensorium becomes dulled. In pneumonia, my results have been uniformly good—better than by any other method of treatment I have ever used. The effects of the baths are immediate, as evidenced by cardiac auscultation, sphygmographic tracings, and general feeling of well-being.

In *acute abdominal affections*, notably appendicitis, the use of opium is contraindicated for a dual reason: it modifies and masks the symptoms and induces a condition of false security. Thus in strangulated hernia one can safely conclude that gangrene has commenced if pain ceases without the relief of constriction, the evanescence of the lump, or the use of opiates. The use of opium in many acute affections of the respiratory apparatus is likewise contraindicated, for it leads to the accumulation of secretions in the respiratory tree, and thus modifies our auscultatory results. In children especially the life of the individual depends on the power to expectorate, which is only effected by coughing. Opiates anesthetize the bronchial mucosa and give a false impression of relief. Opium must likewise be used with reserve in nephritis and gastric affections. In the latter, opium in even moderate doses is followed by anorexia, nausea, and vomiting, and we are often in doubt whether to ascribe the symptoms to the drug or to an aggravation of the malady. Codein is preferable to opium or morphin, owing to its less disagreeable after-effects. Pain must not always be regarded as an indication for *analgesics*, although it is often an important ally. We have long recognized the almost intelligent function of muscles, whether displayed in fixing a diseased joint or spine or in protecting an inflamed serous membrane. If it were not for the immobility caused by the pain, more serious consequences would ensue in fractures and dislocations. Thus it is that symptomatic treatment is not always indicated, insomuch as it may deprive us of signs which signalize the diagnosis and progress of a disease. When we desire to search for the plasmodium malariæ in the blood in suspected malaria, we must avoid giving quinin, otherwise all efforts to find the organism will prove fruitless. The haphazard use of drugs in emergency cases contributes to many sources of error in diagnosis. Here the patient is indiscriminately alcoholized, strychninized, faradized, and oxygenized, and one in consequence is often left in doubt whether the patient is suffering fom alcoholism, strychnin intoxication, or hysteria. Digitalis is a much used and abused drug. The non-recognition of its toxic and cumulative action conduces to serious mistakes. This drug in physiologic doses is essentially a heart tonic and diuretic, yet, when inordinately pushed, it leads to cardiac enfeeblement and suppression of the urine. In Germany pills of digitalis are used by malingerers to escape military duty, the drug creating symptoms suggestive of cardiac trouble.

There are drugs, like atropin, hyoscin, and duboisin, the physiologic action of which is to produce *hallucinations* even in a well person, and it is necessary to add that, when given to a person whose mind is hanging in the balance, the danger is always great. Dr. B. D. Evans has collected a number of cases of insanity caused by the employment of atropin and like drugs as a cure for drunkenness.

Apoplexy may also be cited as an instance where meddlesome therapy does harm by strenuous efforts to restore the patient to consciousness. Here the initial shock or syncope arrests the hemorrhage by reducing the blood-supply. Take, again, thrombosis of a cerebral vessel. Here the patient is indiscriminately purged, thus rendering the blood more coagulable than before.

The employment of morphin in *renal colic* may do more harm than good. In this condition enormous doses are necessary and there is always danger of the drug inducing anuria. In this condition a teaspoonful of pure chloroform acts more rapidly and efficiently than any other remedy (Lilienthal). The strangling sensation following the ingestion of chloroform is immediately relieved by a small draft of water.

Drug eruptions (dermatitis medicamentosa) often lead to errors in diagnosis. They are due to idiosyncrasy or overdosing. *Medicinal Rashes* are characterized as follows:

1. There is usually a history of medication; 2. The rashes appear suddenly, are symmetrical and diffused, attacking exposed and protected surfaces alike, and are unattended by fever; 3. The rashes usually disappear rapidly after the withdrawal of the drug.

Any local irritation, such as a mustard plaster or pin-scratch, in an individual subject to *Psoriasis* may develop new lesions at the point of irritation. Gowers states that psoriasis may be produced artificially by the internal use of sodium biborate.

Feigned Eruptions of the skin when covered with plaster or some fixed dressing rapidly disappear when the patient is unable to create the artificial eruption.

Erythema.—Redness of the skin in patches of variable size and shape:

1. From *balsamic drugs, e. g.*, turpentine, copaiba, sandalwood oil, etc., whether given by the mouth or used by inhalation. Erythema may be urticarial or scarlatinous in character. Fever is not present, the mucous membranes are unaffected, and the eruption may burn or itch.

2. *Antipyretic group:* Quinin, antipyrin, salipyrin, aspirin, pyramidon, urethan, and the salicylates. The eruption from quinin may resemble measles or scarlatina. Even the throat may present the appearance of an angina. In susceptible individuals the local application of antipyrin may produce an eczematous or erythematous rash.

3. *Narcotic and hypnotic group:* Chloral, morphin, belladonna, stramonium, cannabis, and sulphonal. Opium and its preparations may cause intense itching.

4. *Metallic group:* Mercury and arsenic. The mercurial exanthem is often scarlatinous in character and may be attended by fever. The folliculitis caused by mercurial inunctions is due to mechanical causes. The erythema of arsenic is usually associated with other toxic symptoms of the drug.

Local erythema, which may partake of an erysipelatous character, can be provoked by the local application of certain drugs. The eruption may involve not only parts which have come into direct contact with the drug, but even covered parts, like the genitalia. Such drugs are arnica, chrysarobin, chloroform, orthoform, tannin, iodoform, etc. One must never forget that cheap anilin dyes used in underclothing and stockings are often the cause of obstinate cutaneous eruptions.

Acne.—Papular, pustular, or tubercular skin lesions are provoked by preparations of iodin and bromid. The local eruptive phenomena are prone to occur at points of previous inflammation (comedones, scars, scratches), and traumata, pressure, and quick changes of temperature may precipitate an eruption in tissues charged with the drug.

Whereas erythema is the usual cutaneous manifestation of intoxication, the following lesions may be noted:

Bullæ (large blisters): caused by aconite, cannabis, chloral, copaiba, iodin, morphin, and quinin.

Cyanosis (blueness of skin, lips, etc.): coal-tar products (antifebrin, acetanilid, etc.).

Desquamation: following erythema caused by quinin.

Ecthyma (flat superficial pustules): bromids.

Eczema: borax, chrysarobin, iodoform, potassium bicarbonate.

Furuncle: arsenic, bromids, iodids, quinin.

Gangrene: arsenic, ergot, iodids, quinin.

Herpes: salicylates.

Pigmentation: arsenic, picric acid, silver salts (argyria).

Psoriasis: in predisposed individuals, borax and bichromate of potash may cause a psoriatic eruption.

Purpura (cutaneous hemorrhages): chloral hydrate, chloroform (inhalation), iodids, quinin, salicylic acid, sulphonal.

Pustules: aconite, arsenic, bromids, chloral, iodids, salicylic acid.

Urticaria: bromids, copaiba, iodin, quinin, salol, santonin.

Vesiculæ (small blisters): aconite, cannabis, chloral, copaiba, iodin, morphin, quinin, turpentine.

Zoster: arsenic.

The eruption sometimes following the injection of *antitoxin* resembles that of measles, scarlatina, or urticaria. The recognition of medicinal rashes is not difficult. The history of the patient and the associated constitutional signs of the particular drug aid in diagnosis. The latter will be more fully discussed in the second division of this chapter.

Chromo-diagnosis.[5]—I have coined this hyphenated word to describe a method of diagnosis by aid of colors. One may use colored glass, or, better still, sheets of gelatin of various colors. The patient faces the light; and the physician, the patient. Magenta or red-colored gelatin or glass brings many veins into prominence which are undetected by the naked eye. Yellow will bring the movements of the diaphragm into prominence. Green causes reddish skin areas to appear black, like silhouettes, while yellow intensifies the red color of cutaneous lesions. Violet intensifies the most insignificant erythematous patch. Blue intensifies brown spots on the skin. Violet causes yellow skin lesions to assume a salmon-pink color. The use of the foregoing colors refers to the effects in daylight. Icteric coloration cannot be detected by gaslight, but when the violet gelatin is used, yellow is seen as a dark yellow. Acetylene light may substitute daylight when the diagnosis of color is necessary.

Detection of Drugs in the Urine.—Only reference is here made to methods available for the practitioner.

Aloes, Rhubarb, and Senna.—Brownish-yellow urine turns red on the addition of an alkali (sodium or potassium). Even the external application of chrysophanic acid (which is related to this group) may show the same reaction.

Antifebrin.—Urine is extracted with chloroform, and to the extract mercuric nitrate is added. Heating the mixture produces a green color.

Antipyrin.—On adding a ferric chlorid solution, a brownish-red color gradually appears.

Bromid of Potassium.—Add to the urine a few drops of a calcium chlorid solution and hydrochloric acid and a few cubic centimeters of chloroform. The latter will become yellowish-brown owing to free bromin.

Carbolic Acid.—Urine becomes black on exposure to the air. The identical color change occurs after the ingestion of fol. uvæ ursi and tar. With the distillate, to which 5 per cent. sulphuric acid has been added, ferric chlorid will produce a violet-blue color.

Copaiba and Sandalwood Oil.—Hydrochloric acid added drop by drop produces a precipitate of resinous acids of a reddish or violet color with copaiba and a reddish-brown color with sandalwood oil.

Iodid of Potassium.—Add 10 drops of crude nitric acid and a few cubic centimeters of chloroform and shake. The chloroform which settles at the bottom exhibits a reddish or violet color.

Iron.—When present in large quantities, the addition of ammonium sulphid shows a greenish-black color.

Mercury.—Concentrate urine by reducing to half of its volume by boiling. Acidulate with pure hydrochloric acid and introduce two or three tiny strips (1 mm. wide and 3 mm. long) of pure bright copper-foil. Heat all almost to boiling for fifteen minutes. Remove foil, which is then washed with water, then alcohol, and then dried by filtering paper. Mercury is indicated by a silvery film on the copper-foil. The film should not be accepted as conclusive evidence, but another test should be made. The dry foil is put into a small glass tube closed at one end, and the latter heated to a red heat above the copper (heating the latter to be avoided) and prolonged into a capillary end. After the glass tube is allowed to cool, the end containing the foil is heated red-hot in a flame. The mercury will condense at the upper end of the tube and the tiny globules of mercury can be detected by a hand-lens or microscope. The capillary end of the tube is broken, and after a fragment of iodin is introduced, stick the broken end of the tube into a piece of cork and put the tube away in a warm place for about an hour. The brilliant red mercuric iodid is thus formed.

Methods heretofore employed for the recognition of mercury in the urine have not been practical. Lombardo bases his method on the fact that mercury in the urine reacts to chlorid of tin, which reduces it to metallic mercury, which is recognized microscopically. The method is as follows: In a tube of the centrifuge are poured 5 c.c. of the filtered urine; one drop of albumin of an egg is added and then agitated; to this is added 3 c.c. of 12 per cent. solution of chlorid of tin (filtered at moment of using and hyperacidified with 25 per cent. of hydrochloric acid). The specimen is centrifuged for a few minutes and then the precipitate is placed on a glass slide and examined under the microscope with a power of 600 diameters. If mercury is present, minute black globules of metallic mercury are seen. A reaction with normal urine should be made for comparison.

Phenacetin.—The dark yellow urine turns reddish-brown on adding ferric chlorid, and on standing becomes black.

Pyramidon.—The addition to the urine of an equal volume of a 2 per cent. solution of ferric chlorid produces a darkish-brown amethyst color.

Quinin.—Render urine alkaline with caustic potash, and then shake with ether for five minutes, which takes up the quinin. Now remove and evaporate the ether and dissolve the residue in water containing a few drops of muriatic acid. The latter solution, upon the addition of strong chlorin water and ammonia, exhibits a green color.

Santonin.—With the saffron-yellow or greenish urine the addition of sodium hydrate will produce a reddish color.

Salicylates and Salol.—The addition to the urine of ferric chlorid drop by drop will exhibit a violet color.

Tannin.—Excreted as gallic acid, the reaction is identical with the latter, viz., a bluish-black color upon the addition of ferric chlorid solution.

A *greenish-yellow or yellowish-brown urine* may be caused by carbolic acid, guaiacol, naphthalin, resorcin or santonin.

A *bluish urine* may be caused by methylen blue or sweets colored with it. Urine which becomes black on standing may be caused by carbolic acid, pyrocatechin, salicylic acid, or salol. Eosin in the urine may be mistaken for blood. A violet odor is present when the patient has taken turpentine.

Interfering Action of Drugs and Food in Urinary Examinations.—*Color.*—In abnormal coloring of the urine the use of some drug must be suspected. The ingestion of large quantities of water makes the urine pale. Owing to the presence of hematoporphyrin after the continuous use of sulphonal, trional, and tetronal, the urine is brown or black in color. An olive-green or black urine, especially after long exposure to the air, may be caused by carbolic acid, coal-tar products, resorcin, hydroquinone, pyrocatechin, salol, naphthalene, and uva ursi. A saffron-yellow or greenish color may be caused by santonin, and a yellow or reddish-brown urine by cascara, rhubarb, senna, or chrysarobin. The pigment of beets, huckleberries, and madder may color the urine.

Amount.—Increased ingestion of water and diuretics will increase the quantity of urine.

Odor.—Valerian, leek, castor, asafetida, copaiba, cubebs, saffron and turpentine (violet odor) impart their particular odor to the urine. Meat, bouillon, coffee, and asparagus have a like effect.

Reaction.—The *acidity* of the urine can be increased by an excess of food, especially proteids, sugar, and starch, by a deficiency of water, by wines, and by drugs: by benzoic, salicylic, and boric acids and tartaric and citric acids in excess. The *alkalinity* is increased by the alkaline drugs. During digestion, the urine may become alkaline, owing to the secretion in the stomach of hydrochloric acid; hence, urine voided after eating may be cloudy, owing to the precipitation of the earthy phosphates and carbonates. Foods containing alkaline citrates, tartrates, acetates, and carbonates, like milk, fruits, and fish, render the urine alkaline. A strictly vegetable diet has the same effect.

Specific Gravity.—This serves as an adequate index of the amount of solids excreted in the urine. The ingestion of large quantities of fluid diminishes and small quantities of liquid and food increase the specific gravity.

Acetone.—The severity of diabetes may be frequently gaged by the quantity of acetone in the urine; the larger the amount, the more severe is the disease. It occurs, however, in traces in every normal urine. It is increased with a meat diet and in inanition. *Diacetic acid* is practically always associated with acetone. It is an interesting fact that in diabetes insipidus some patients will void an amount of urine in excess of the water ingested.

Albumin.—Methylene-blue yields a precipitate with Esbach's reagent. Copaiba, sandalwood, and turpentine are precipitated by the nitric acid test for albumin, hence this test is untrustworthy in the presence of such drugs. Terpin hydrate also yields a precipitate with nitric acid. Cubebs and coal-tar give a precipitate with chromic acid, although no albumin is present. The addition of strong alcohol by dissolving the precipitate removes all doubt. The heat test will give a precipitate in the presence of myrrh tincture. We must not forget that drugs like turpentine, salicylic acid, mercury, cantharides, and carbolic acid, owing to their irritating action on the kidneys, may cause albumin to appear in the urine (toxic albuminuria). An excessive repast of proteid food may cause temporary traces of albumin (dietetic albuminuria).

Chlorids.—They are diminished or absent in inanition, starvation, and diarrhea.

Diazo-reaction.—This reaction is of diagnostic value in typhoid fever and of prognostic importance in tuberculosis. A similar reaction is obtained from the internal use of the following drugs: Alcohol (in large quantities), chrysarobin, creosote, cresol, dionin, guaiacol, heroin, morphin, naphthalin, opium, and tannin.

Hemoglobinuria.—The presence of blood-coloring matters may be caused by carbolic acid, carbon monoxid, muscarin, naphthol, sulphuretted hydrogen, and potassium chlorate. Quinin may also cause it, especially in those who have been subjects of malarial fever. A delicate test for blood is the following: Fill a test-tube one-fourth with warm acidulated urine, then a drop of official tincture of guaiac is added, and the precipitate of resin which results is dissolved by the addition of strong alcohol. One or two or, at the most, three drops of 15 per cent. hydrogen peroxid solution are then added. If blood is present, the usual blue color appears either at once or after several seconds; in order to hasten its appearance the fluid may be gently warmed. In cases in which blood is to be sought for in the urine one should first ascertain whether iodin or bromin is present. Morinelli highly commends *Hydrogen Dioxid* as a very sensitive test which is uninfluenced by albumin, mucus or bile pigments. It is only positive when it occurs within a minute. A few drops of a concentrated solution of the reagent are added to about 15 c.c. of urine in a test-tube without stirring or heating. Bubbles in the urine indicate the presence of blood.

Indican.—The reaction of this product may be confounded with the reaction of iodin in those taking the iodids, insomuch as in the usual test for indican with chloroform and hydrochloric acid the color of the iodin is imparted to the chloroform. Denigès found that the addition of a crystal of sodium hyposulphite destroys the color of the iodin without affecting the indican.

Oxalates.—A sediment of these crystals occurs after the use of food containing oxalic acid, such as fruit, and especially tomatoes.

Pentoses.—These are carbohydrates which may appear in the urine of healthy persons after the ingestion of large quantities of cherries, plums, and other fruits rich in pentoses (alimentary pentosuria). Pentosuria, although bearing no relation to diabetes mellitus, may be mistaken for that disease, because the pentoses possess the property of reducing copper after prolonged heating. If phloroglucin and fuming hydrochloric acid are added to the urine containing pentose, an intense red color is developed upon warming (Tollen's reaction).

Phosphates (Earthy) and Carbonates.—They occur in the sediment under conditions which favor the alkalinity of the urine. They frequently follow vomiting and gastric lavage because the acidity of the urine is diminished owing to the loss of hydrochloric acid from the stomach.

Sugar.—This may be of transient occurrence (glycosuria) after intoxication from amyl nitrite, carbon monoxid, chloral hydrate, morphin, phloridzin, sublimate, etc. (toxic glycosuria). An excess of sugar or other carbohydrates may induce alimentary glycosuria. The recognition of glucose in the urine by polarization is negatived by the presence of arbutin, benzol, peptones, quinin, and other levogyrate products. All the latter, however, do not reduce Fehling's solution. The Nylander bismuth reagent for sugar is quite reliable, but the following, which reduce the agent, must first be excluded: eucalyptol, kairin, morphin, quinin, rhubarb, salicylic acid, senna, turpentine, etc. It is quite likely that all the latter depend upon the presence of combined glycuronates. Glycuronic acid is formed in the body by oxidation of dextrose. It escapes complete oxidation when it can combine with the foregoing, and thus appears in the urine. Glycuronic acid does not ferment, but it reduces alkaline copper solutions.

Urea.—The greater the body-weight and ingestion of food, the greater the formation of urea.

Uric Acid.—This is only one of a number of grouped substances called purins, because all contain the nucleus purin ($C_5H_4N_4$). Other purins are: xanthin, guanin, methyl xanthins (caffein and theobromin), etc. Uric acid constitutes nine-tenths of the purins in the urine. Certain articles of food (meat, sugar, fat) increase, while an exclusively milk diet decreases, the output of uric acid. The determination in the urine of xantho-uric bodies is negatived by the presence of caffein, theobromin, rhubarb, and the iodids.

II. DRUGS IN THE ETIOLOGY OF DISEASE.*

In common with other observers, I frequently encounter patients who are really suffering from the effects of drugs given for therapeutic purposes, and one is constrained to recall a quotation from Vergilius, "and he becomes worse from the very remedies used" (*aegrescitque medendo*). Such effects are often quite independent of the toxicology of the drugs in question, and thus developed, could appositely be called "medicamentous diseases." For example, we frequently prescribe the inhalation of the smoke of various antispasmodic agents for arresting asthmatic attacks. As a result, large quantities of carbon enter the bronchial tree and maintain essentially a foreign-body bronchitis. I have seen many intractable cases of bronchitis associated with asthma disappear after the disuse of smoking antispasmodics. In practically all my bronchial asthmatics who have developed tuberculosis the latter has been of the fibroid variety, which further emphasizes the intimate association of the latter disease with the inhalation of carbon and other foreign matter. Asthmatics addicted to the smoking of antispasmodics are usually anemic and badly nourished. They are confined for many hours in a tainted atmosphere, and if they escape phthisis, it is merely an accident, for they violate every recognized rule for its prevention. When the physician innocently prescribes morphin or cocain, he may initiate two recognized diseases—morphinism and cocainism. I have seen many chronic dyspeptics who owe their trouble to nauseous drugs. Accidental ivy-poisoning is common, and the toxic principle of poison ivy is a fixed oil known as toxicodendrol. Now, the toxic principle is destroyed by alkalies; hence alkaline applications to the skin are indicated. Physicians who employ vaselin or ointments succeed in dissolving the toxicodendrol, causing it to become diffused over a larger surface, and thus aggravate the affection. Toxicodendrol forms insoluble compounds with lead; hence the efficacious effects from the latter in poisoning. It is not necessary to dilate further on this subject, other than to recall an aphorism which, although old, is full of significance, "the remedy is worse than the disease."

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* In the discussion of this subject reference is made to the untoward effects of drugs when administered in the treatment of disease (therapeutic overaction). It is evident, however, that we cannot exclude the toxicology of the drugs. The physiologic action of the latter will be discussed in the subsequent chapter.

Acetanilid.—Idiosyncrasy toward this drug is common. It depresses the heart, and even small doses have been followed by cyanosis, profuse perspiration, and collapse. In poisoning only, dyspnea and changes in the red corpuscles occur. Papular and erythematous rashes may occur, but less frequently than with antipyrin. Even when applied externally to raw surfaces, the drug may produce constitutional symptoms. Persistent use leads to anemia.

Many of the so-called *Headache remedies* contain acetanilid, but the pure food regulations compel manufacturers to print on their labels the fact that the drug contains acetanilid, hence the name acetphenetidin (which is just as dangerous) is substituted.

Prophylaxis.—The effects of the dose last for about three hours, hence repetition of the doses is only permitted after the lapse of this time. Its action is cumulative and its use should be suspended for a day or more. In the anemic, debilitated, and aged it must be given with caution. Stimulants should always accompany the administration of the drug.

Acid, Boric.—Continuous use of this drug, externally or by enema, has been followed by a train of symptoms (borism): digestive disturbances, alopecia, dryness of the skin and mucous membranes, skin eruptions, edema, and albuminuria.

Prophylaxis.—The drug is ordinarily harmless, but it is well to remember that its indiscriminate use may lead to the foregoing symptoms.

Acid, Carbolic.—Intoxication from the external application is not uncommon. Its continuous use has been followed by gangrene. Internally, in small doses, no appreciable effects are noted, but in extra-therapeutic doses it depresses the heart, quickens respiration (later, slowed), and reduces the bodily temperature. Eliminated chiefly by the kidneys, owing to irritant action on the latter, ischuria and albuminuria may ensue. Early symptoms of intoxication from its use externally are: a smoky or greenish-black urine, pallor, headache, vertigo, and muscular weakness. Drugs of the same class producing like symptoms are: **Anilin, lysol, resorcin,** and **pyrogallol.**

In the rare condition known as *ochronosis*, characterized by pigmentation of the tissues, especially the cartilages, tendons, and skin, there are cases on record where the patients had used carbolic acid freely on chronic leg ulcers. The condition of the urine produced by the absorption of carbolic acid is known as carboluria. The change in color of the urine usually appears a little time after the latter is voided, whereas the smoky hue of hematuria is observed immediately after the urine is passed. In carboluria the sulphates are diminished or absent when the acidulated urine is heated with chlorid of barium, for the reason that carbolic acid forms soluble sulphocarbolates; hence there is a diminished precipitation of sulphates with barium chlorid.

Prophylaxis.—The dose of the acid should not exceed from one to five drops, and the maximum daily allowance should not be in excess of 15 minims. The menstruum should be glycerin, in which it is perfectly soluble, and then, well diluted with water, taken preferably after eating. If the acid has been brought in contact with external parts, immediate washing with absolute alcohol is efficient in neutralizing its caustic action. To counteract its toxic action when taken internally, about three ounces of diluted alcohol should be introduced into the stomach through a tube, to be followed by washings with Epsom salt, which unites with it to form an innocuous sulphocarbolate. If carboluria is present, the use of the drug must be discontinued. Chlumsky[316] uses camphor for neutralizing the corrosive action of carbolic acid. He uses a mixture in erysipelas consisting of 30 parts of pure carbolic acid, 60 parts of camphor, and 10 parts of alcohol, which is applied with a brush several times a day. Camphor evaporates easily, hence camphorated phenol must be kept in well-stoppered bottles.

Acid, Hydrocyanic.—Slow respiration, giddiness, faintness, nausea, cyanosis, dilated pupils, frothing at the mouth, involuntary urinary and fecal discharges, and muscular twitching.

Prophylaxis.—Used externally in diluted form to relieve itching; it must never be employed on a raw surface, especially on areas which have been wounded from scratching.

Aconite.—Tingling or prickling sensation of lips, tongue, and mouth; sensation of numbness, especially in the extremities. Clutching throat sensations, dysphagia of hydrophobic character, salivation, nausea, and vomiting. Slow, feeble, and irregular pulse, shallow respiration, and prostration.

Prophylaxis.—It should only be used in small and repeated doses and the effects watched. Aconitin should not be used internally, as the preparation is unreliable and very toxic. In the external use of aconite avoid abraded surfaces, as there is danger of absorption.

Alcohol.—Many irreparable errors have been made in misinterpreting the symptoms of acute alcoholism. First of all, a subject of this kind must not be neglected. His intoxication is as dangerous as intoxication by any other drug. In addition to being drunk, he may have some cranial injury, or, if a woman, an attack of hysteria. Some resort to alcohol because they are sufferers from some acute or chronic disease; and, finally, alcohol in some form may have been given to the sufferer, and the smell of alcohol should not be construed erroneously. The difficulty in diagnosis arises in determining the nature of the coma. Aside from the alcoholic odor of the breath, the pupils are dilated, the temperature is below normal, the face is usually flushed and cyanotic, the coma may be preceded by delirium, and there is no evidence of paralysis or injury.

Chronic Alcoholism.—Tremor in the hands and tongue, mental symptoms, notably, irritability, forgetfulness, loss of memory, and failure of judgment. What is known as *Korsakoff's psychosis* is usually of alcoholic origin, although other poisons, like those of infections (tuberculosis, influenza, typhus fever), may cause the same mental state. The chief symptom is falsification of memory, *i.e.*, gaps in memory are filled by fabrications. A patient who may have been in bed for weeks, when asked where he had been on the previous day, tells in detail, with apparent lucidity, that he went to the theater, narrates all about the play, the actors, the people whom he saw, etc. Associated with the latter sign is a defect of memory (amnesia) and polyneuritis; hence the other name, *psychosis polyneuritica*, to designate the condition. Osler notes another symptomatic picture, viz., a heavy drinker begins to get drowsy, which passes gradually into stupor and coma. The latter condition may exist for weeks. Fever may be present, but there are no signs of paralysis nor optic neuritis. Among other symptoms may be noted digestive disturbances, cirrhosis of the liver, arteriosclerosis, and delirium tremens.

Anthelmintics.—Filix-mas (*Aspidium*). This remedy, most often employed for tapeworm, causes in overdoses abdominal pains, vomiting, purging, vertigo, headache, etc. Blindness, temporary or permanent, has been noted, due to degeneration of the optic nerves. **Pomegranate** (*granatum*), used as a teniafuge, may produce vertigo, headache, nausea, vomiting, muscular weakness, and dimness of vision. **Kousso** (*cusso*), while efficient as a teniacide, is repugnant to the taste and causes griping. **Santonin:** This is the best remedy for the round-worm. It may produce yellow vision (xanthopsia), which is sometimes bluish at first. The urine is yellowish-brown or even purplish-red if it is alkaline. Among other symptoms are: vertigo, tremors, nausea, and vomiting. **Spigelia:** This causes pupillary dilatation, dimness of vision, flushing of the face, and swelling of the eyelids.

Prophylaxis.—Any condition which will favor the absorption of anthelmintics may lead to toxic symptoms. Thus, filix-mas should not be given with oils (castor oil) which render this agent soluble. Spigelia is given with a purge. Santonin possesses advantages over the other anthelmintics on account of the small dose necessary and freedom from disagreeable taste. It should always be given with a purgative to prevent toxic symptoms, which may arise unexpectedly if the drug is allowed to remain in the intestines. Unlike other anthelmintics, its absorption is supposed to be inhibited by fats. In the diagnostic employment of the anthelmintics I usually administer them in combination, and not infrequently I am compelled to give the mixture through a stomach-tube, otherwise the patient is unable to retain it.

Antimony.—Tartar emetic given to children, who are very susceptible to continuous doses, and put surreptitiously into alcoholic drinks to cure the drink habit, may cause poisoning. The symptoms are like arsenical poisoning, viz., nausea, metallic taste, colic, gastro-intestinal disturbances, vertigo, nystagmus, etc. Applied to the skin, tartar emetic may cause the appearance of vesicles, pustules, and sloughs.

Antipyrin.—Even in small doses it accelerates the respirations. It weakens the heart and conduces to depression and collapse. In large doses its action on the hemoglobin causes the blood to become chocolate in color. Its administration may eventually cause anemia. Owing to the irritant action on the stomach, nausea and emesis may ensue. Used as an antipyretic, the reduction of temperature is accompanied by profuse perspiration. The skin eruptions of the drug have been referred to elsewhere. It may induce a persistent irritation of the mucosa of the nose and throat. Even after the use of 10-grain doses, collapse, cyanosis, and swelling of the eyelids and extremities have occurred.

Prophylaxis.—It must be used with caution in elderly people and in those with weak hearts. Affections of the kidneys contraindicate its employment. Children appear to enjoy a tolerance toward it. The drug should be prescribed with some stimulant (alcohol, ammonia), and when the stomach is intolerant, it may be given as an enema wth opium or in a suppository.

Antitoxin.—The antitoxin of diphtheria is commonly employed, and an urticarial or erythematous rash and an arthralgia (6 per cent. of the cases) are frequent, though unimportant and fugacious symptoms. A slight elevation of temperature (20 per cent. of the cases) of short duration may follow the injections. An abscess at the site of the injection must be attributed to some error in aseptic technic. Post-diphtheritic symptoms (paralysis, albuminuria) are not caused by the antitoxin, but occur more frequently because there are more recoveries.

Prophylaxis.—The antitoxin must be fresh and obtained from a reliable source. It deteriorates with age. It is an innocuous agent, and the only danger attending its use is in employing it in insufficient dosage. Several instances have been reported of sudden death following injections. Similar deaths have followed injections of equally innocuous agents when a vein has been punctured by the needle and the medicine has been injected directly into the circulation. In the *Status Lymphaticus* the most trifling injury will at times produce fatal results. Thus it is that Prof. Langerhans' son died soon after receiving a hypodermic injection of diphtheria antitoxin. Escherich recognizes the status lymphaticus by the following signs: pale thin skin, pasty complexion, plenty of subcutaneous fat, signs of rickets or scrofula, enlarged lymph-glands, hypertrophy of the tonsils and circumvallate papillæ of the tongue, adenoids, increase of lymphocytes in the blood, a palpable spleen, an enlarged thymus, a history of laryngismus stridulus in the child and fainting attacks in adults. Vaccination has been discredited because physicians have neglected the elementary principles of asepsis, and the use of antitoxin will be discredited for the same reason by the unreasonable minority who employ medical progress as a medium for their own delinquencies. It is easier to establish a fact than to have it accepted. The credulous in medicine believe too much and the skeptics believe too little. The skeptic in medicine is too often the man who prescribes proprietary medicines because less mentality is necessary in accepting the statement of the patentee than in learning about the new fact of the scientist.

Apomorphin.—This is the ideal remedy used hypodermically for inducing vomiting. It has a depressing action on the heart and accelerates the pulse.

Prophylaxis.—It must be employed with caution in children and in infirm subjects. Only a fresh preparation should be used, as it rapidly deteriorates with age and with exposure to light and air. The tablets are convenient and efficient, from which the solution may be prepared.

Arnica.—Owing to its irritant properties, it is an emeto-cathartic poison. After a stage of excitement it depresses the circulation, respiration, and temperature. There are also headache, dilated pupils, and muscular weakness.

Prophylaxis.—Owing to its infrequent employment internally, the therapeutic effects may be noted after its external use. It is a powerful rubefacient, although slow in action. Abraded surfaces must be avoided.

Arsenic.—Symptoms usually follow the prolonged use of the drug, especially in children, when it is given for chorea. Arsenic is used in the manufacture of colored papers, artificial flowers, and wearing apparel, and intoxication from such sources has been noted. In wall-paper containing arsenic the action of certain molds will create a volatile oil which may induce poisoning through the lungs. It must be observed that symptoms have developed several weeks after the drug has been discontinued. The notable symptoms from therapeutic overaction are: conjunctivitis and catarrh of the air-passages, anemia, gastro-intestinal disturbances, and polyneuritis. Koplik has shown that arsenic is a renal irritant and that albumin in the urine may precede edema of the eyelids, hence a study of the urine serves as a delicate test of the point of tolerance for arsenic. If a trace of albumin appears, arsenic must be stopped irrespective of the smallness of the dose or how excellent the general condition. The skin lesions following its prolonged use may consist of pigmentation of the skin, herpes zoster, and hyperkeratosis. Warts and corns have been attributed to its use, and eleven cases of epithelioma have been collected by Hartzell, occurring in psoriasis and evidently due to the continuous use of arsenic.

Prophylaxis.—Although the Styrian peasantry (arsenic eaters) employ the drug among the women for beautifying the complexion, and among the men for increasing their physical endurance, no such tolerance has been established in other countries. The peasants use arsenious acid, and the daily allowance has been as high as 10 grains. Some people are very susceptible to the action of the drug, hence one must commence with small and gradually ascending doses. The advent of gastro-intestinal symptoms (nausea, colicky pains) and puffiness under the eyes indicate a temporary suspension of the drug. It must always be given alone, well diluted, and after meals. It must not be used if the patient is a dyspeptic. Children bear arsenic better than adults.

Aspirin.—This may cause a transient edematous swelling of the face and scalp, numbness of the cranial nerves, palpitation, difficult breathing, and extreme weakness.

Belladonna (Atropin).—Dryness of the throat and dysphagia; dilated pupils, confused vision, relaxed bowels, increased pulse-rate, flushing of the face and conjunctivæ, rapid respiration, restlessness, and an erythematous rash. Belladonna employed as a prophylactic in *scarlatina* often produces an abundant scarlatiniform eruption in children. The urine of a person with pronounced belladonna intoxication, when dropped into the eye of any animal except birds, will dilate the pupils.

Prophylaxis.—Children are more tolerant to the drug than adults. The injudicious use of belladonna or its preparations to the skin, especially in the presence of abrasions or erupted skin areas, may be followed by intoxication. Its use in the eye may cause congestion and edema of the lids and conjunctival catarrh. Atropin increases intraocular tension, hence it is not to be used in glaucoma nor in persons past middle life, in whom tension of the eye is augmented. Applied to the eye in susceptible persons, the patient should be instructed to press the finger against the lacrimal sac for a few minutes after each instillation. It may often be necessary to substitute some other mydriatic for atropin. Belladonna must not be used during lactation owing to its tendency to dry up the milk. It is evident that should any symptoms of intoxication become manifest, the drug must either be reduced in dosage, suspended, or discontinued. Patients should be warned to remove belladonna plasters or cease the use of the drug externally if dryness of the throat or disorders of vision occur.

Bromoform.—Since the introduction of this drug for pertussis by Sepp, in 1889, ill-effects have frequently followed its use: viz., nausea, vomiting, diarrhea, pallor, perspiration, staggering, dilated pupils, heart failure, and collapse.

Prophylaxis.—The frequency of intoxication has been usually the result of faulty administration. It may be given dropped on sugar or dissolved in compound tincture of cardamom, to which syrup of orange may be added. The drug should not be used if colored or acid in reaction. It must be kept in well-stoppered bottles.

Bromids.—Bromism from the continuous use of bromids may develop any of the following signs: gastric disturbances, fetor of the breath, anemia, eruption of acne, mental depression, somnolence, unsteady gait, diminution of the reflexes, muscular weakness, and sexual failure. Tickling of the fauces does not induce gagging. There may be an edema of the fauces and later of the conjunctiva. In rarer instances the following have also been noted: ptosis, paresis of the limbs, impairment of sight, hearing, and tactile sense, and cardiac and respiratory failure. Starr[225] reports cases of bromid intoxication mistaken for paresis.

Prophylaxis.—The full physiologic action of the bromids is attained as soon as the palatal reflex is abolished. This is true provided the palatal reflex has been demonstrated before taking the drug insomuch as there are many individuals who fail even in the norm to show the reflex in question. Very often the several salts of bromid (sodium, strontium, ammonium) act better and in smaller dosage than the most commonly used salt (potassium bromid), which, containing 44 per cent. of potassium, is the most powerful depressant of them all. The addition of small doses of potassium iodid, antipyrin, or acetanilid will, according to Stevens, lessen the amount of bromid required. When the heart is weak, digitalis or some other heart tonic should be used in combination with the bromids. To prevent the skin eruptions, a few drops of Fowler's solution with each dose of bromid is efficacious.

The efficacy of the bromid is much enhanced by a *salt-free diet.*

Bismuth.—When this drug was formerly contaminated with arsenic, poisoning resulted. Excessive doses may cause constipation. The garlicky odor of the breath is due to tellurium impurities in the bismuth. The black stools are due to the conversion of bismuth into a sulphid in the intestines. The external use of bismuth preparations (dermatol, airol, thioform) in the treatment of wounds and abscess cavities has resulted in poisoning with symptoms corresponding to mercurialism, viz., stomatitis, gastro-intestinal disturbances, nephritis, etc. Recently Meyer has reported three cases of death from large doses of bismuth subnitrate. It has been established experimentally that nitrites can be formed in the intestine from this preparation. Insomuch as this drug is now used in large doses in *x*-ray examinations the danger can be minimized by employing bismuth subcarbonate, the dose of which is the same as the subnitrate.

Caffein.—In susceptible persons even small doses cause nervous excitement and wakefulness; in large doses, rapid breathing, acceleration of the pulse, delirium, cardiac distress, vertigo, tinnitus aurium, and flashes of light.

Prophylaxis.—Contraindicated in insomnia, even when given in the daytime. Caffein decomposes in the presence of water, hence it must be given in powders or capsules, or as the sodiobenzoate of caffein, which is a soluble and stable solution, available as well for hypodermic use. Caffein irritates the gastric mucosa, and its persistent use may be followed by signs of gastro-intestinal irritation. In valvular heart disease care must be exercised in its use. Several instances of death have been reported from repeated doses (gr. iv), and at the necropsies death was found to be caused by a "tetanus of the heart muscle."

Cannabis Indica.—The effects are essentially confined to the nervous system, and although at times alarming, no death has ever been reported. Mental exhilaration and hallucinations, perverted sensibility, and general anesthesia are signs of its physiologic action.

Prophylaxis.—Most preparations in the market are uncertain in action and unreliable, hence one must always begin with small doses of the drug.

Cantharides.—Used externally in susceptible individuals, urinary distress, strangury, bloody urine, vesical irritation, and even nephritis, have occurred. Taken internally, it is an intense irritant, and symptoms similar to those occasionally following its external use may supervene. Some assume that counterirritants induce hyperemia of the superficial and anemia of the deeper structures, whereas others contend, with equal vigor, that there is likewise a hyperemia of the deeper parts. It has been shown that a blister applied directly over the pericardium may aggravate the condition, and the same observation applies to joint inflammation. It is evident, then, that in the latter condition counterirritants should be applied above or below a joint, but not directly over it. I have noted several times that when a blister had been used over a painful thoracic area, a pleural friction sound could be heard, although absent previous to the application of the counterirritant.

Prophylaxis.—In the very young, old, and debilitated persons, cantharides for blistering purposes must be used with care, otherwise sloughing may follow. In diabetes like care must be taken, and in all renal affections the use of cantharides should be interdicted. If cantharides must be used externally in subjects like the foregoing, it is wise not to wait for vesication, but to complete the latter by the application of a poultice.

Cathartics.—In evacuation of the gastro-intestinal canal by means of purgatives, we must not forget that, accompanying their action, an increased supply of blood is sent to the abdominal organs; hence all conditions dependent on intra-abdominal congestion (*splanchnic neurasthenia*[6]) are intensified. In some individuals vertigo and a sensation of weakness attend the use of purgatives, for the reason that a temporary brain anemia is induced, owing to the excessive blood present in the splanchnic area. One must not forget that collapse symptoms following the use of cathartics in enfeebled subjects are also caused by reflex irritation of the vagus (p. 55). Aloes has a special tendency to congest the rectum and pelvic organs, and must be avoided in affections of the rectum and pelvis associated with congestion and in pregnancy. The giving of a cathartic in suspected cases of *intestinal obstruction* will often aggravate the symptoms, and this fact is equally valuable in a diagnostic sense. Harris has directed attention to the following conditions which are intensified by cathartics: closure of the intestine (strangulated hernia), localized spasmodic constriction (which demands opium), appendicitis, and peritonitis. When a portion of the intestine is paralyzed, which may occur in ptomain poisoning, active cathartics can produce intussusception by driving the healthy contracted bowel into the paralyzed relaxed portion (Hatcher and Wilbert).

Prophylaxis.—We must avoid bowel evacuation in nearly all acute abdominal affections, in intestinal hemorrhage, and in all debilitated patients. In the latter, purgatives and even laxatives are powerful heart depressants, and if the bowels must be evacuated, enemata are advisable and the bowels must be voided in the recumbent posture. In hemorrhoids and other rectal affections, in pregnancy and during menstruation, only the mildest laxatives must be used. Elderly people do not tolerate saline purgatives unless they are given warmed or combined with a carminative. To prevent griping, belladonna or some aromatic oil may be added to the purgative. Enemata containing hard soap have at times been followed several hours after by an erythematous eruption. Aloes irritates the rectal mucosa and thus causes straining at stool. The latter is harmful if there is any tendency to lung hemorrhage or if aneurism or a hernia exists. Straining at stool in elderly people, by increasing intra-abdominal pressure and thus putting a strain on the cerebral vessels, predisposes to rupture of the latter. Straining is not wholly a question of pressure. What is known as the *heart reflex*[8] is an inhibition of cardiac action and retraction of the organ in all diameters, the result of irritation of the skin, nasal and gastric mucosa, percussion of the muscles, etc. My investigations show that irritation of the rectal mucosa will likewise temporarily inhibit cardiac action. Some patients, particularly those with weak hearts, suffer from collapse symptoms when straining at stool. In investigating the cause of the symptoms I found that the contraction of the abdominal musculature will cause, even in the norm, a temporary cessation or, at any rate, an enfeeblement of cardiac action. Fig. 1 represents such action by means of a sphygmogram taken while the patient was straining at stool. The depressing action of purgatives is also due to lowering of blood-pressure owing to hyperemia of the abdominal vessels.

Chloralamid.—Headache, vertigo, nausea, and incoordination may be observed.

Prophylaxis.—It must not be prescribed with alkalies, owing to its conversion into chloral. It is decomposed by hot water. Owing to its bitter taste and comparative insolubility, it is better not to give it in powder form, but in solution with an aromatic elixir, to which alcohol is added to aid solubility.

Chloralose.—This is not reliable as far as constancy of action is concerned. Furthermore, in nervous subjects it may excite the patient in lieu of producing sleep. Other symptoms observed are: cyanosis, incoherent speech, nausea, perspiration, and incontinence of urine and feces.

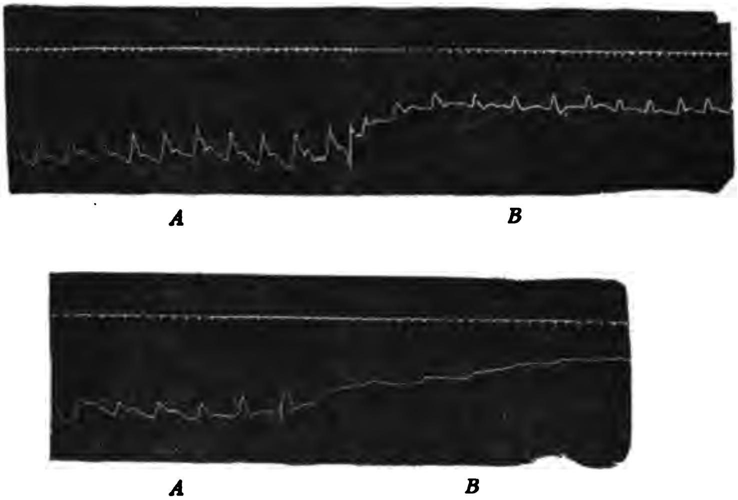

Fig. 1.—Sphygmogram, *A*, before, and *B*, while straining at stool. In the upper figure, the inhibition of the pulse is partial, and in the lower figure it is complete.

Chloral (Chloralum Hydratum).—No symptoms, as a rule, follow the therapeutic use of this ideal hypnotic. Its depressing effects on the heart and respiration hold good only in the subject enfeebled by age and disease. The persistent use of the drug causes a train of symptoms (chloralism): insomnia, dyspnea, palpitation of the heart, and a variety of skin lesions (lividity, rashes, ecchymoses, edema) dependent on vasomotor disturbances.

Prophylaxis.—It must be given well diluted. It is not an anodyne. Given to drunkards and the insane, it may excite rather than soothe such patients, and if so, its use had better be discontinued, for it is one of the drugs which is influenced by idiosyncrasy. Nervous individuals become readily addicted to the chloral habit, hence we must exercise caution in giving it to such patients. We must never use it whenever cardiac weakness is suspected. It is excreted in the urine as urochloralic acid. The latter responds to Fehling's test for sugar.

Chloroform.—About fifty cases of delayed poisoning from this drug have been reported at the present time of writing. The so-called cases of "operative shock" may be merely instances of delayed poisoning from chloroform. The symptoms begin about thirty-six hours after general ancsthesia, with the following signs: prostration, delirium, weak and rapid pulse, dilated pupils, incessant vomiting, and a distinct and constant odor of chloroform on the breath. Jaundice has been observed in about half the cases. The urine is scanty and may contain albumin, bile pigments, urobilin, and acetone. Finally there is coma, which may even be the initial symptom. Death occurs usually in from three to seven days. The lesions noted after death involve the kidneys, heart, and liver. The latter viscus is in a condition of acute fatty degeneration, not unlike the liver in phosphorus intoxication. The apparent danger lies in supersaturation of the tissues with chloroform and suggests intermittent or diluted administration in some recognized mixture. More than half of the recorded cases of delayed poisoning occurred in children. The temperature was usually normal. No adequate explanation has been offered to explain this delayed poisoning. One attributes it to hepatic toxemia, and another to the fact that the chloroform is in some way bound to the tissues. In a case of Guthrie the nerve-centers smelled strongly of chloroform. The immediate after-effects of anesthesia (nausea and vomiting) are well known.

Pneumonia following an anesthetic has been attributed to the following: exposure of the patient, chilling of the lungs by rapid evaporation of the drug, irritating action of the drug, and, finally, owing to the benumbed sensibility of the larynx, the secretions from the mouth (pneumococcus is present in the mouth and bronchial secretions of 20 per cent. of healthy individuals) or food from the stomach are allowed to pass the glottis (aspiration or deglutition pneumonia). Peripheral paralyses are frequent, due to compression of nerve-trunks owing to faulty postures of the limbs which the anesthetist has overlooked. I have seen other instances of palsy following the use of an anesthetic in which neither the latter factor nor exposure to cold was in evidence, and which I could only attribute to a neuritis (toxic). Anesthesia paralyses occur most often when the arm is elevated alongside the head, as in the Trendelenburg position, or held away from the body, as in performing breast operations. Paralyses from cerebral lesions may occur during anesthesia, and a number of cases of apoplexy and embolism occurring at this time have been reported. Epileptic convulsions with fatal issue during anesthesia have been reported.

Prophylaxis.—Pure chloroform is absolutely essential in anesthesia, and decomposition of the drug is indicated automatically as suggested by Breteau and Woog by the following device: It consists in making use of the indicator Congo red for determining the development in the chloroform of even the minutest traces of hydrochloric acid. In order to do this conveniently a small disc of elder pith stained with a solution of Congo red in absolute alcohol is placed in each bottle containing the chloroform. Normally the stained disc retains its color indefinitely, but if, as the result of the action of air, light, moisture, etc., decomposition begins, hydrochloric acid is set free, and the indicator changes from red to blue. The chloroform then should be either discarded for internal use or be repurified. An anesthetic must be used with caution in all instances of respiratory and cardiac disease. A valvular heart lesion does not contraindicate the use of an anesthetic, provided the lesion is compensated. Severe grades of anemia (hemoglobin less than 30 per cent.) make anesthesia a grave maneuver. In diabetes, when acetone is present in the urine, it is a contraindication; the acetone may be augmented and the patient may pass into a state of coma. Beesly[11] shows that chloroform can be given in chronic acetonuria (frequently present in chronic tuberculosis and constantly present in chronic suppuration), with no more danger than to apparently healthy patients, provided the renal and alimentary tracts were eliminating actively.

In acute suppurative conditions, with acute acetonuria, chloroform must be feared. The records show, at the Children's Hospital, Edinburgh, that 83 per cent. of deaths attributed to the after-effects of chloroform occurred in cases of acute sepsis. In Russia quiet narcosis is effected in those addicted to alcohol by getting the subjects half drunk with brandy before giving the anesthetic. A good night's sleep causes the patient to take the anesthetic better than if the rest is broken, and for this purpose a hypnotic may be indicated. Erotic dreams in women during anesthesia are not uncommon, and the surgeon may be unjustly accused, hence a third party should be present.

Guthrie,[304] in a recent contribution on the subject of delayed poisoning by anesthetics, presents the following summary: (1) Operations should be delayed, when possible, if a fatty liver be suspected. It may be suspected in subjects of rickets and infantile paralysis who have been overfed with fattening food and underexercised; in cases of sepsis and diabetes, and when a history of cyclic vomiting is obtained. (2) When a child has recently vomited apparently without cause, an intended operation should be postponed. This precaution has been neglected in many fatal cases recorded. (3) When fatty liver is suspected, the patient should be kept for some days on a diet restricted in fats. (4) Bicarbonate or citrate of soda should be given meanwhile in order to neutralize fatty acids which may be present. Mild purgation may be beneficial. (5) Starvation will give rise to acute acetonuria; therefore nutrient enemata should be given two hours before and immediately after an operation. (6) Although any general anesthetic may be dangerous in the presence of a fatty liver, chloroform is most dangerous of all, on account of its specific action on the liver and kidneys.

The treatment of acid intoxication following operations should be by venesection, saline transfusion, and by clysters of a solution of bicarbonate of sodium. Anesthetics must be used cautiously in the aged and infirm. Many post-anesthetic symptoms may be prevented by the administration of sodium bicarbonate before anesthesia, based on the assumption that the symptoms in question are provoked by acetonemia. Operations on the mouth, nose, and throat are always attended with special danger, owing to the passing of blood into the glottis. In the latter operations, anesthesia should not be profound enough to abolish the reflexes. The stomach should be empty of food, and even a stomach-tube may be used as a special precaution, for I have frequently noted that, owing to nervousness or some other cause, food last eaten (twelve hours before) was at the time of the operation still undigested. Cocainization of the nasal mucosa will, as I have shown elsewhere,[9] inhibit unpleasant cardiac phenomena. The cocain must not be sprayed into the nose, but the mucosa touched with the solution, otherwise the cocain may gain the pharyngeal mucosa and thus abolish reflexes, which are so essential as a safeguard against an aspiration pneumonia. I would suggest, in anesthesia, to occlude the nostrils by means of a simple compressing clamp, so that the anesthetic enters through the mouth. Thus one could avoid the nasal reflexes and, as a larger volume of the anesthetic enters the mouth in a given time, anesthesia will be expedited. The neck of the patient must not be stretched during anesthesia, for in this way the vagus is irritated, as I have shown, and the heart is brought to a sudden stop. The influence of chloroform in inhibiting the heart owing to its influence on the vagus center and its tendency to augment the secretion of saliva and mucus can be prevented by the hypodermic injection prior to the operation of a small dose ($\frac{1}{50}$ grain) of atropin sulphate (Schafer). Chloroform anesthesia should only be attempted with electric light if artificial illumination is necessary, insomuch as chloroform fumes in contact with lighted gas produce irritant vapors which, when inhaled, may cause pneumonia. To prevent nausea following anesthesia the patient must be instructed to keep the eyes closed. The inhalation of vinegar, and a teaspoonful of burnt brandy, have been suggested for the same purpose, and even morphin by hypodermic injection may be used if vomiting is severe. Some of the anesthetic is swallowed during anesthesia, and if the stomach is washed out with warm water, post-operative emesis is less pronounced. Vomiting from chloroform is usually more difficult to control than vomiting from ether.

To prevent possible lung complications, the patient must be carefully covered and carried to a well-ventilated room properly heated to the requisite temperature.

We must remember that sudden death has occurred in children during anesthesia for the most trivial operations, notably in the removal of adenoids. This occurs in the condition known as the *status lymphaticus*, or lymphatism. Unexpected deaths (*thymus tod*) in such conditions have arisen from an antitoxin injection or some equally trifling procedure. It is not always easy to recognize the lymphatic state. The superficial glands, tonsils, mesenteric and thymus glands are enlarged. The latter may be detected by an area of dullness on percussion along the left sternal border from the second to the fourth ribs. To facilitate the detection of the dullness, my *vibrosuppressor* may be used, or the lower end of the sternum may be pressed upon during the time percussion is executed. Such pressure restrains vibration of the bone, which interferes with the underlying dullness. The subjects are usually pale, with pasty complexion, and are fat and flabby. No adequate cause has been assigned for the "thymus tod." Persistence of the thymus gland in adults may also be responsible for sudden deaths during anesthesia.

Chloroform anesthesia must be uniform, and superficial narcosis disturbs the operator, owing to reflexes (contraction of muscles, nausea, vomiting): deep narcosis, which is dangerous, may be avoided by attention to the following table of symptoms indicating progressive deepening of narcosis. The table is after Gumprecht.[21]

Cessation of conscious sensations.	Excitation. Vomiting occurs, as a rule, after and not in the beginning of narcosis.	Pupils dilated to the maximum; pupil and corneal reflexes present; pulse strong and is not slowed or only slightly so.	Pupils contracted to the maximum; pupil reflex absent, but corneal reflex may be present or lost.	Pupils dilated to the maximum with *absent* pupil reflex; corneal reflex usually absent; eye has lost its luster; pulse weak; cyanosis or pallor.	Arrest of respiration and, less often, arrest of the heart.	Arrest of the heart.
I	II	III	IV	V	VI	VII

Zones of narcosis.

The *death-rate* from anesthetics, according to the most creditable statistics, is as follows:

Ether	1 in	15,000	administrations
Chloroform	1 "	3,000	"
Nitrous oxid	1 "	1,000,000	"
Ethyl chlorid	1 "	4,500	"

Nitrous oxid with oxygen is probably the safest anesthetic and freer from after-effects. It is true that this anesthetic has chiefly been used by dentists for a few seconds, hence we do not know what the effects will be after prolonged anesthesia such as is necessary in surgical operations. In obstetric practice, this anesthetic induces analgesia and anesthesia without relaxation of the muscles nor in any way interfering with uterine contractions.

It has been noted that when chloroform is used at night in the presence of a naked flame in the room, it induces coughing and irritation of the respiratory tree in consequence of its being decomposed and giving off nascent chlorin. Dawbarn[231] suggests suspending handkerchiefs in the room which have been dipped in ammonia to obviate the latter difficulty; ammonium chlorid thus formed is not irritating. For the prevention and treatment of post-operative suppression of the urine following anesthesia, notably in cases of pre-existing nephritis, Stuart McGuire[286] suggests the use of sulphate of spartein hypodermatically in from 1 to 2 grains, repeated every three to six hours. Its action is manifest in thirty minutes after administration and lasts for four or six hours. It is a heart tonic and a powerful diuretic. Post-operative vomiting, according to MacArthur, is caused by irritation of the gastric mucosa produced by the copious salivary secretion mixed with ether which trickles down into the stomach during an operation. He combats such post-operative symptoms very successfully by having the stomach full of water at the time of the operation. The inhalation of oxygen immediately after the operation is also effective in preventing vomiting.

To prevent the formation of bronchial secretions during anesthesia, Venable[310] found the use of adrenalin very satisfactory after the following manner: He found that a 25 per cent. aqueous solution of the standard 1 : 1000 gave the best results, and that by first pouring ether in the towel cone and spraying the adrenalin solution on it, depending on the ether to vaporize it sufficiently for inhalation, was the best mode of administration. Three- to six-minute intervals are sufficient for its use, and a total of from one-half to one ounce of this solution is enough for an operation lasting from thirty minutes to an hour. The effects are a more uniform etherization, the pulse becoming steadier, slower, and of better character more rapidly than under ether alone; respirations are quiet and regular, the bronchial secretions are practically checked, and the progress is not interrupted. The adrenalin, acting generally from absorption, lessens shock and capillary ooze at the field of operation.

Rectal etherization, suggested by Roux in 1847, has never come into general use, owing to irritation of the large intestine and prolonged stupor. However, it has been commended in operations about the face, mouth, and larynx. A bottle of ether is placed in water (temperature, 122° F.) and a rubber tube connected with the bottle is introduced into the rectum. The anus as a reflex center, as I have endeavored to show, may be regarded as the analogue of the nares.*

Cocain.—The symptoms in poisoning from the therapeutic use of this drug are usually of short duration (about an hour), and recovery ensues without the aid of stimulants. The signs are: perspiration, pallor, dilated pupils, vertigo, heaviness and weakness in the limbs, and dryness in the throat. With more pronounced intoxication, we have exaltation, delirium, and hallucinations, syncope, and collapse. Death may follow from paralysis of the heart and respiration, which may be preceded by convulsions. The symptoms usually occur within five or ten minutes after the use of the drug, or they may be delayed for as long as an hour. The chronic use of the drug (cocainism) presents the following symptoms: dilated pupils, mental excitement and impairment, physical unrest, gastric disturbances, and a rapid loss in weight. When the psychic symptoms are pronounced, there are feelings of fright, provoked by hallucinations in the visual and sensory spheres. The patient scratches himself, believing that insects or worms are under his skin (cocain bug). Untoward effects of mild degree caused by medullary cocainization are: fever, vertigo, headache, nausea, and vomiting. Uterine contractions have followed such cocainization and labor has been induced. It is stated[10] that lumbar puncture anesthesia has been followed by a higher death-rate than the administration of either chloroform or ether.

Prophylaxis.—The individual susceptibility to cocain is so varied that in using it for the first time we must always exercise caution. Children and neurotics, especially women, react badly. Solutions of more than 4 per cent., when used in the eye, may cause degeneration in the epithelium of the cornea. In eye pains of presumable glaucomatous origin, cocain must be interdicted, as it hastens the development of a glaucomatous attack previously threatened (Javal). Aqueous solutions of the drug when heated lose their potency. Cocain solutions do not keep, hence they should be freshly prepared. Cocain (the alkaloid), but not its salts, is soluble in fats and oils; hence the base only should be used when prescribed with fats and oils.

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* Post-operative *backaches* may be caused by continuous lying on a hard, flat surface during anesthesia, and may be prevented by keeping the body and limbs slightly flexed with pads for the support of the shoulders, knees, and especially the small of the back.

In the local application of the drug weak solutions (2 per cent.) applied at five-minute intervals will accomplish the same result over a longer period of time as stronger solutions. The primary cocain application anemizes the parts and thus prevents the absorption of subsequent applications. When using solutions in an atomizer, the bottle should be graduated so that the quantity used may be known. Solutions applied with a brush or cotton applicator may be used in greater strength with diminished danger of intoxication. Adrenalin added to cocain solutions diminishes the danger of the latter. Recalling the fact that symptoms of intoxication may not ensue until an hour after the use of cocain, it is advisable to have the patient on whom it is used for the first time wait at the office of the physician until the lapse of the hour.

In using cocain hypodermatically one must remember that the urethra and face are especially dangerous regions. More than $\frac{2}{3}$ of a grain upon a mucous surface and more than $\frac{1}{3}$ of a grain hypodermatically must not be employed with the object of avoiding intoxication. Insomuch as hot are more efficient than cold solutions of cocain, the former are used in preference because less of the drug is required. If before using cocain a drop of a 1 per cent. solution of nitroglycerin is used hypodermatically, the danger of cocain intoxication is diminished.

Colchicum.—Overdosage is characterized by abdominal pain, griping, nausea, vomiting, diarrhea, and occasionally by dysuria and hematuria. Owing to the slow absorption, symptoms may develop after the use of the drug is suspended, and relapses of toxic symptoms are not uncommon. Chronic diarrhea may occur as a sequela of overdosage.

Prophylaxis.—This drug is cumulative in action and its effects must be watched during administration. Its continued use is generally without the good effects primarily noted, whereas the toxic action may always be in evidence. Discontinue its use on the advent of abdominal distress, and always begin with small doses. Owing to its irritating action on mucous membranes, give it well diluted, and preferably after meals.

Copaiba (Cubeb and Sandalwood).—Owing to the irritant action on the gastro-intestinal mucosa, these drugs may cause nausea, vomiting, purging, and colic. They may induce difficulty in micturition, burning pains in the urethra and lumbar region.

Prophylaxis.—We may recall that the acid resin of copaiba precipitated from the urine by nitric acid is distinguished from albumin by the fact that it disappears on the addition of alcohol. We must not forget, however, that albumin may be present as a result of overdosage. All the foregoing drugs are very unpleasant to the taste, and are usually given in capsules after meals. Cubeb and sandalwood are less irritating than copaiba and less apt to be followed by the symptoms above noted.

Copper.—Chronic poisoning is characterized by the following: greenish discoloration of the skin and hair, colic, paralysis, marasmus, nephritis, etc.

Creasote (*Creosotal and Guaiacol*).—In action similar to acid, carbolic (*q. v.*), but less irritating. The use of guaiacol externally has an undoubted antipyretic effect, and the temperature fall is associated with depression and profuse perspiration of short duration.

Prophylaxis.—Soluble sulphates (Epsom or Glauber salts) are chemical antidotes (Hare). Care should be exercised in obtaining a preparation of creasote free from carbolic acid. It is best given in capsules after meals or followed by a large glass of water. Begin with small doses and increase gradually. I usually prescribe empty capsules and a reliable preparation of the drug, and instruct the patient to fill the capsules in ascending dosage. Guaiacol must not be used for antipyretic purposes in enfeebled subjects, owing to the collapse symptoms attending its use.

Digitalis.—Symptoms of toxicity are not infrequent owing to variations in strength of the preparations and cumulative action.

The latter is particularly frequent when there is a scanty secretion of urine or after the removal of transudates by paracentesis. Death has occurred as a result of rising from a bed in persons under the influence of the drug. Even in ordinary cases when digitalis is administered the pulse may suddenly become rapid and feeble if the patient sits up in bed. Overdosage is manifested by fall of the blood-pressure and cardiac enfeeblement. The latter shows the following: rapid, irregular, and thready pulse, precordial distress, syncope, and diminished flow of urine. The eventual failure of respiration is through the circulation. Headache, nausea, depression, giddiness, and disturbances of vision are frequent symptoms of medicinal doses.

Prophylaxis.—Some of the theories established for the purpose of creating indications and contraindications for the use of digitalis suggest to me the story of the German professor who received a bed as a present. Until the small hours of the morning he busied himself with abstruse calculations to determine whether he was large enough for the bed or if the latter were large enough for him. Finally he was struck with the happy idea of getting into the bed, and to his intense delight discovered that it was admirably suited to his proportions. So it is with digitalis; this valuable cardiotonic is often relegated to oblivion owing to the numerous theories which indicate and contraindicate its employment. No theory can guide the practitioner in its use, and its tentative administration is always warranted, provided small doses are given and one is prepared to recognize its untoward effects. It is not indicated because a valvular heart lesion exists; on the contrary, it must be withheld as long as the lesion is compensated; but should incompensation occur, which is characterized by a rapid, weak, and irregular pulse, deficient urination, and dropsy, then its use is indicated. There is one class of theorists who interdict its use in fatty degeneration of the heart muscle, yet Balfour suggests that in the early stages of this degeneration it acts favorably in small doses. We will have cause to refer again to the action of digitalis in the next chapter.

When giving the drug, the patient should be seen frequently; and when given in large doses, the patient should be confined in bed, or at least made to assume a recumbent posture. The latter exaction is necessary for a dual reason: rest in recumbency facilitates the action of the drug and prevents untoward symptoms, as already explained. The drug should be suspended for at least a day every week, to avoid its cumulative action, and in the interim caffein, strophanthus, or some other cardiotonic may be given. It is unnecessary to add that we discontinue its use when the full physiologic effects are asserted. We are often compelled to discontinue digitalis on account of its bad effects on the digestive apparatus. In such instances its use by the rectum is almost as efficient, or it may be given hypodermatically. The latter route, with a reliable preparation of digitalin, is often prompt and efficient; in fact, it is often the only route, owing to the delayed absorption of digitalis in persons in whom it is indicated.

Ergot.—In large doses it is a gastro-intestinal irritant, but in small doses there are no such effects. One observes occasionally, following the use of the drug, creeping sensations and cramps in the limbs, ataxic gait, and motor and sensory disturbances which are referred to the contractile influence of the drug on the arteries. In chronic poisoning (ergotism) from the ingestion of bread made of ergotized grain, two types exist: (1) Spasmodic ergotism: sensory peripheral disturbances, malaise, muscular spasms, vomiting, diarrhea, and headache. (2) Gangrenous ergotism: gangrenous patches in various regions of the body, but notably in the fingers and toes, and cataract. Degeneration of the posterior columns of the spinal cord has occurred from ergot, resulting in a condition resembling locomotor ataxia.

Prophylaxis.—Most preparations are unreliable. The contractile effect of the drug on the uterus, especially the pregnant organ, has led to its abuse. Its use must be limited to uterine inertia without any obstruction in the passages. After the completion of the second stage of labor, there is little danger attending its use.

Ether (*vide* Chloroform).

Ether and Chloroform (compared as anesthetics).—Mortality: chloroform is at least three times more fatal than ether.

Respiratory apparatus: chloroform is less irritating than ether in affections of this apparatus, and is preferred to ether when it is desirable to eliminate the irritant action of vapors.

Heart: ether stimulates and chloroform depresses this organ, hence in cardiac troubles ether is preferable.

Effects on other organs: Fatty degeneration of the viscera occurs less oftén with ether than with chloroform. While albuminuria may occur after etherization, it is less pronounced than in chloroformization, and usually disappears in about two days after anesthesia (Wunderlich). Nausea following chloroformization is more severe and protracted. In a word, chloroform is dangerous in comparison to ether, and is only indicated in the presence of respiratory diseases and when rapid anesthesia is urgently demanded.

Iodids.—The symptoms of iodism are largely identified with the physiologic action of the iodids, which, by affecting the mucosæ, induce catarrhal conditions. The nasal and lacrimal secretions are increased, and frontal headache, sneezing, increased flow of saliva, salty taste, laryngeal and pharyngeal catarrh are frequent symptoms. Skin eruptions are usually acneiform, but may be eczematous. Nervous symptoms: irritability and depression, and, when the doses are large, signs like bromism are developed. The gastro-intestinal effects are of an irritant character: nausea, vomiting, colic, and diarrhea. Symptoms resembling Graves' disease have been observed in several instances, viz., tremors, sweating, cardiac palpitation. Other symptoms noted: loss in weight, atrophy of the mammæ and testicles.

Prophylaxis.—It is difficult to determine the correct dose of the iodids, for small doses may induce toxic signs which are averted by larger doses. This paradox is explained by Cyon as follows: small doses unite with products of the thyroid gland to form toxic iodothyrin, whereas larger doses are diuretic and form soluble salts which are rapidly eliminated. In general, the iodids are given in small doses, gradually increased, and their use must be suspended on the advent of iodism. Idiosyncrasy is observed in Bright's disease. For those who cannot take potassium iodid, tincture of iodin has been suggested instead, in doses of from 10 to 30 drops, in a little wine or water. For the persistent metallic taste of the iodids, Lewin suggests a mouth-wash consisting of two teaspoonfuls of spiritus cochlearia in a glass of water. Given by mouth, the iodids must be well diluted in milk or Vichy water, as diuresis reduces their toxicity. Many springs owe their good results to the large quantities of hot water taken with the iodid. Potassium iodid acts efficiently when given by rectum when it is not tolerated by the stomach. The coryza effects may be controlled by the coincident use of belladonna or atropin. Fowler's solution, in the proportion of 5 drops to each 15 grains of the iodid, is efficient in controlling the skin eruptions and digestive disturbances. The face must be kept scrupulously clean, insomuch as the skin eruption is probably caused by the disintegration of the iodids by the fatty acids of the sweat.* Children tolerate the drug better than adults. Compound syrup of sarsaparilla and extract of licorice disguise the taste of the iodid, and many find milk an efficient vehicle for the same purpose. Sodium iodid may be substituted for the potash salt when the latter is not tolerated by the stomach. We must remember that some regard the iodids as antigalactagogues; hence their use must be interdicted during lactation. They must be used cautiously or not at all in acute laryngeal or bronchial affections, for the reason that several instances are noted of acute laryngeal edema attending their use. A pure preparation of potassium iodid minimizes the danger of iodism. Tests: An aqueous solution of potassium iodid, practically pure, does not become turbid upon the addition of a few drops of acetic acid. Put some of the solution in a test-tube and add 5 drops of a solution (1 : 10) of potassium bichromate and 5 drops of sulphuric acid. Heat: violet vapors indicate iodin and yellowish-red vapors indicate adulteration (chlorids and bromids).

Iodoform.—Aside from the local irritating effects (erythematous and pustular eruptions) from its external use, its absorption from wounded surfaces, especially in enfeebled subjects and in those with Bright's disease, must not be forgotten. Such intoxication has resulted in death, especially in individuals beyond middle life. The symptoms of intoxication bear some resemblance to meningitis, especially in such instances when high fever is present, viz., headache, mental depression, pupillary contraction, rapid pulse, nausea and vomiting, delirium, etc. The drug is tasted in the mouth. On account of the offensive smell of the drug, other agents, notably iodol, have been substituted. The latter is less likely to produce the untoward effects of iodoform. Iodoform is detected in the urine by mixing a little of the latter in a saucer with a small quantity of calomel. A brown color indicates the presence of the drug, which, however, does not prove that the patient is poisoned.

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* For removing the skin-fat apply light friction with cotton which has been soaked in carbon bisulphid saturated with sulphur (this solution is inflammable).

Iron (Ferrum).—Discoloration of the teeth and tongue is caused by the formation in the mouth of a black sulphid or tannate of iron. The stools are also black for a like reason. Digestion may be disturbed even in the norm and constipation is frequent.

Prophylaxis.—It must not be given unless the gastric functions are normal, and then after meals, well diluted. The albuminates and peptonates of iron are more easily absorbed than the inorganic salts and are less likely to discolor the teeth and upset digestion. To overcome the constipating action of iron, it may be given with a laxative, and we may profitably recall that the carbonate, citrate, pyrophosphate, and reduced iron are the least astringent.

Jaborandi (Pilocarpin).—Disturbances of vision, circulatory depression, pulmonary edema, and swelling of the salivary glands, nausea, vomiting, and purging may be noted when pilocarpin is given by the mouth.

Prophylaxis.—Ringer claims that children are more tolerant than adults to the drug. Pilocarpin, which is the alkaloid usually prescribed, excites contractions in unstriped muscles; hence, it must not be given in pregnancy. Its use must be interdicted in those with weak hearts and in pulmonary affections.

Lead.—Chronic poisoning (saturnism or plumbism) is most frequent among workers in lead mines, smelting works (where silver-bearing lead carbonate ores are refined), plumbers, painters, lead-pipe makers, type-founders, type-setters, etc. Here the poison is introduced by means of the lead-laden dust. Accidental poisoning occurs from the ingestion of food. The latter may be contaminated by lead salts, by the use of cooking utensils lined with an enamel containing lead, from fruits in soldered cans, from beer or water conducted through lead pipes, or when water is stored in lead-lined tanks; the use of hair-dye and cosmetics containing lead; wines and cider which are acid take up lead very quickly. Osler reports instances of poisoning from the use of lead and opium pills for dysentery. While plumbism is usually chronic, acute cases also occur. Thus, Da Costa reported an instance of hemiplegia after three days' exposure to lead, and even in workers in lead, symptoms may arise acutely after a short exposure.

The main symptoms of poisoning are: colic, lead-palsy, and cerebral symptoms (encephalopathy). The colic is associated with constipation and is relieved by pressure. Paroxysms of colic may be accompanied with diarrhea. The abdomen during the attack is flat and the pulse is quite characteristically slowed down to 30 beats a minute. It is also hard and shows increased tension, which is confirmed by taking the blood-pressure, which is increased.

LEAD-PALSY most frequently affects the upper limbs. According to localization, the following types of paralysis are recognized.

1. Antebrachial type, which involves the extensors of the fingers and wrists. Here the musculospiral nerve is involved, giving rise to the classic wrist-drop. The supinator longus is not usually implicated.

2. Brachial type, which implicates the deltoid, biceps, brachialis anticus, and supinator longus.

3. Aran-Duchenne type, which involves the small muscles of the hand and the thenar and hypothenar eminences. This form, which shows a high grade of atrophy, has been noted most often in tailors.

4. A peroneal type, involving the lateral peroneal muscles, the extensor communis of the toes, and the extensor of the big toe.

5. The laryngeal type, producing adductor paralysis.

There may be generalized palsies, occurring acutely or chronically, with rapid wasting of all the extremities. There may be neuralgic pains (saturnine arthralgias), with or without sensory disturbances. The cerebral symptoms are: insanity, delirium, unconsciousness, and trance-like attacks. Other nervous symptoms are: optic neuritis, tremor, hysterical symptoms in girls, convulsions, and epilepsy. Osler cautions us not to forget plumbism as a possible cause of convulsions occurring in adults. Arteriosclerosis (with associated contracted kidneys and hypertrophy of the heart) is a frequent condition in chronic lead-poisoning. Gouty deposits (lead gout), especially in the big toe-joint, are not uncommon. Icterus (icterus saturninus) may be present.

Two symptoms of importance in diagnosis are: (1) A blue-black line at the margin of the gums, caused by the conversion of the lead in this situation into a black sulphid by the action of sulphuretted hydrogen. This line is not present in the absence of teeth. This line must not be confounded with a black line caused by carbon deposits in miners, nor by a line on, and not in, the gums, which is removable by cleansing the teeth and washing the mouth. (2) Anemia is almost constant, but what seems of special importance is the presence in the blood of nucleated red blood-corpuscles and a basophilic degeneration of the red cells.

Prophylaxis.—Workers in lead must devote much time to washing their hands with sapolio and ammonium tartrate. All hygienic principles should be maintained in places where lead is used, and even respirators must be worn. Food should not be eaten on the premises. Potassium iodid, vaunted as a prophylactic measure, is questioned, although it is undoubtedly useful, forming, as it does, a lead and potassium iodid, which is soluble. Epsom or Glauber's salt forms with the lead an insoluble sulphate, and is therefore a chemical antidote. The value of sulphur baths is questionable, although they should be tried, viz., potassium sulphuret (4 ounces) with 20 gallons of water in a wooden tub. We must not forget that acute plumbism may occur in children, caused by toys containing lead. The symptoms consist of abdominal pains, constipation or diarrhea, and fever, which has been known to be mistaken for malaria. The use of lead pipe in water systems should be abolished by law.

Mercury.—Therapeutic overaction is first manifested in the mouth (ptyalism): soreness of the teeth when the jaws are brought forcibly together, soreness of the gums, and redness and puffiness of the margins of the latter, fetor of the breath, metallic taste, and increased flow of saliva. Later, if the drug is not withdrawn, the teeth loosen, the tongue and parotid glands swell, and the tissues of the mouth ulcerate and the bones necrose. Other symptoms are anemia, loss of flesh, digestive disturbances, chills, and fever. We must not confound the latter with syphilitic fever, which may occur at any period in the secondary stage, or only at the time of the eruption. The pyrexia may pursue a continuous, remittent, or intermittent course, and is often mistaken for malaria. It has also been confounded with typhoid fever and tuberculosis.

Chronic mercurialism may follow the continuous use of the drug for therapeutic purposes, or may occur among artisans who handle the metal, makers of thermometers, mirrors, and scientific instruments, gilders, electrotypers, and miners who handle ores of mercury. Aside from the symptoms already noted, we have the following: tremor, nephritis, rheumatic pains and arthralgias, hypochondriasis, and convulsions which are essentially epileptic in character. The psychic disturbances (erethismus mercurialis) consist chiefly of depression, embarrassment, and confusion.

Acute mercurialism has been noted even after insignificant doses of calomel in susceptible persons.

The external use of mercury has been followed by severe poisoning, and erythema, acne (from inunctions), and eczema are frequent. The crowns of the teeth and the openings of the salivary ducts in the mouth may show brownish discolorations, due to the chemical union of mercury and sulphur. Death due to heart paralysis and lung edema has followed the soluble salts of mercury used subcutaneously. Some of the soluble salts are: cyanid, lactate, perchlorid, and sozoiodol.

Moulinier[314] and others have shown that mercury may cause lesions of the suprarenal capsule, and that pigmentation and muscular fatigue, noted in syphilitic patients undergoing mercurial treatment, may be due to the influence of this drug on the capsule in question.

Prophylaxis.—In giving even moderate doses of calomel, a purgative should accompany or follow the administration. We must not forget that mercury is slowly eliminated, and that an attack of ptyalism may recur without evident cause, especially after the use of potassium iodid and baths of sulphur. An instance is related by Ogier, where mercury could be detected in the urine thirteen years after the cessation of mercurial treatment. Calomel must not be given coincidentally with the iodids owing to the formation of the irritant mercuric iodid.

1. Mercury is badly tolerated by anemic and exhausted individuals. A tonic treatment must precede or accompany the mercurial course.

2. Examination of the urine must precede the use of the drug, for if nephritis exists, mercury must be used cautiously or not at all. During treatment the urine must be examined repeatedly to prevent mercurial nephritis. Albuminuria may be of syphilitic origin, hence the cautious use of mercury may cause its disappearance. If the albumin, however, should increase, the drug must be suspended or the amount reduced.

3. Mouth or abdominal symptoms indicate disuse of the drug.

4. Mouth hygiene should be most pedantic. Previous to treatment, the mouth should be put in condition by a dentist. The teeth should be brushed after each meal, followed by a mouthwash with a saturated solution of potassium chlorate. The use of tobacco must be stopped.

5. Mercury is especially harmful in pregnancy, particularly in the latter months, resulting in either abortion or mercurial intoxication of the child.

Oral sepsis resulting from mercurialism has often resulted in systemic infection, for the mouth is a favorable nidus for pyogenic organisms. In obscure instances of pyogenic infection, whether mercury has been used or not, examination of the mouth is imperative, and the presence of pyorrhea is very suggestive in the absence of other causes. Wadsworth[277] investigated the bactericidal value of mouth-washes, and found that many of them are without value, notably, listerin, borolyptol, glycothymolin, etc. Normal salt solution merely cleanses the mouth, but does not destroy the bacteria. The most efficient of all agents for destroying the bacteria was alcohol, the action of which was accelerated by the addition of glycerin. He employs a 30 per cent. solution of alcohol in water, to which a small quantity of glycerin and salt are added.

For the thorough cleansing of the nasopharynx, Schmidt suggests gargling with closed mouth, and to prove that the fluid enters the region in question, by inclining the head forward some of the fluid will pass through the nose.

To prevent the irritant action of mercury on the alimentary canal, opium may be given coincidentally, although my observations show that the latter drug, by preventing elimination by the feces, may hasten the toxic action. The latter may be advantageous when, for convenience or otherwise, mercury is given by the mouth and we wish to hasten its physiologic action.

6. Diet must be nutritious, sleep and exercise plentiful, care of the skin rigorous, and if possible attention to business suspended.

7. Remember that in nervous individuals mercury may develop nervous symptoms.

8. Mercurial dermatitis from inunctions, especially in hairy individuals, may be avoided in part by the use of talcum, zinc paste, and improved methods of inunction. If such measures fail, mercury may be used by the mouth, under the skin, or by the rectum.

9. Potassium iodid assists in the elimination of mercury in instances of overaction.

10. In people without teeth the mouth symptoms may be absent. In children ptyalism is rarely observed, and this fact may give the physician a sense of false security, for no one questions that the child is nevertheless intoxicated by overdosage.

11. During mercurial treatment the tendency to "catch cold" is increased, hence warm underwear is indicated and undue exposure should be avoided.

Corrosive sublimate employed in the irrigation of wounds may irritate the tissues, and the tendency to infection may be increased. After the tissues are irrigated, drainage must be employed. It should not be used upon serous membranes or joints, as it is quickly absorbed and is destructive to the endothelial cells. It is usually employed externally in the following strengths:

1. Irrigation of small wounds	1 : 2000
2. Irrigation of large wounds and cavities	1 : 10,000 to 1 : 5000
3. Irrigation of vagina	1 : 10,000 to 1 : 5000
4. For gargling	1 : 10,000 to 1 : 5000

PROPHYLAXIS OF SYPHILIS.—*En passant*, mention may be made of the prophylactic value of mercurial salve in syphilis. Metchnikoff and Roux prove experimentally that a 33 per cent. calomel and lanolin salve rubbed on the spots of suspected inoculation within two hours after intercourse with a syphilitic woman will prevent syphilitic infection. Who can demonstrate the point of inoculation? Why not rub the salve over the entire organ or, better still, use it in lieu of vaselin before copulation? Eventually, vaginal suppositories of calomel may be effectual. More recently Metchnikoff[361] recommends an ointment composed of 33 grains of calomel to 67 of lanolin and 10 of vaselin. He assures us that the prophylactic value of this ointment has been fully established by the most rigorous experimental tests. It is efficacious, however, only when employed during the first few hours after contact with syphilitic virus. Further investigations by the same experimentist seem to indicate that when more than a few hours have elapsed after contact with syphilitic virus (a time when the calomel ointment is no longer efficient), a single injection of *atoxyl*, even delayed until the fifteenth day after inoculation, is capable of preventing infection. He warns us, however, of the possible danger of inducing toxic symptoms (including impairment of vision) when large doses of atoxyl are used. Hallopeau, who employs atoxyl in the treatment of syphilis, recommends an injection of 75 cg., followed by a second injection of 60 cg. and a third of 50, making a total of 185 cg. With such doses he has never observed any sign of intolerance or intoxication. The salve of calomel may be put to a variety of uses, among which I may suggest its use as a lubricant for anointing the fingers in the examination of suspected syphilitic patients. Another prophylactic measure is excision of the chancre, which, according to Fournier, yields one success in five cases. In any event such excision will diminish the severity of the subsequent syphilitic symptoms. Cauterization of the chancre may also diminish the severity of the subsequent symptoms.

Morphin (Opium, Codein, Heroin, etc.).—Acute poisoning from overdosage is not infrequent. The symptoms are: sleep, contracted pupils, slow respirations, pallor, relaxed muscles, the patient is aroused with difficulty or not at all, and finally coma. In chronic poisoning (morphinism): anemia, loss of flesh and strength, sallow complexion, disturbed digestion, diarrhea, pains, tremor, mental depression, irritability, and insomnia. Untruthfulness, loss of self-control, moral obliquity, a sense of impending evil, and irresolution are psychic signs. An habitué of morphin may suffer from chills and fever, suggesting malaria. The drug is excreted into the stomach even when used hypodermatically.

If the stomach is washed, the washing may be examined for morphin by adding a little fresh sodium iodate solution, a few drops of dilute sulphuric acid, and a little starch paste: a blue color. This test is delicate.

Prophylaxis.—The morphin habit may often be traced to the physician's carelessness. The history of heredity must interdict its use. It must be given to neurotics and to victims of alcohol and cocain with great caution. It ought never to be used as a hypnotic, its field of usefulness being limited to the relief of pain. Prescriptions containing it must never be repeated without the physician's order, and, last of all, the reprehensible habit of putting the drug and the hypodermic syringe in the hands of patients is criminal. While pain may be regarded as an antidote of opium and its preparations, the tendency to dose too quickly to relieve pain may be attended by dire consequences. In my early practice I almost lost a patient from poisoning because I acted with more precipitation than reflection. I yielded to the importune patient for more morphin, and when the latter was effective, I was confronted with cumulative action. The drug should be repeated at regular intervals, and under no circumstance must we depart from this rule. In diabetes large doses of the drug are tolerated. In nephritis even small doses have proved fatal. Children are very sensitive to its action, and if given to the latter, even in very small doses, its effects must be watched. In respiratory and circulatory affections, where the cough reflex is so essential to remove accumulated secretions, it is dangerous to abolish it by opium. If there are no secretions and the cough is purposeless, its use is indicated. Even when the bronchial secretions are slight, it may be used, for the tendency of the drug is to check all secretions except perspiration. The after-effects of opium and its preparations, viz., headache, nausea, vomiting, and depression, may be relieved by the coincident use of atropin or potassium bromid. Atropin, however, should be avoided in cerebral excitement, especially mania. Females are more susceptible to morphin than males, and we must not forget that some are excited rather than soothed by the drug. The latter is an idiosyncrasy which can only be thwarted by asking the patient if any drug has ever acted unfavorably. The specific mention of opium had better be avoided.

Paraldehyd.—In action it is similar to chloral, but not so depressing to the heart. Its continuous use may be followed by exanthemata. The severe toxic signs may be likened to alcoholic coma. Its taste and odor are exceedingly unpleasant, and the latter may be detected in the breath for many hours after its administration. It is prescribed in capsules with some aromatic, followed by a large glass of water. It is a very reliable and usually a safe hypnotic.

Phenacetin.—Action similar to acetanilid, but decidedly less toxic; in fact, it is the least dangerous of all coal-tar antipyretics and untoward symptoms are rarely noted.

Peroxid of Hydrogen.—This drug must not be injected into a deep abscess unless a large opening exists, as otherwise the evolved gas may spread infection by laceration of the tissues. The continuous use of the drug causes granulations to become edematous and retards healing. Its continued use may actually prevent a sinus closing (Da Costa). Irrigation of the pleura with peroxid has been followed by air-embolism. In wounds involving the cellular tissue it is better to avoid hydrogen peroxid, as it demonstrates a tendency to dissect loose cellular tissue and thus spread infection.

Phosphorus.—Symptoms from overdosage are rare. This drug, used largely at one time in the treatment of rachitis, has been discredited. It was prescribed with cod-liver oil, and the good effects could be attributed to the latter; in fact, Zweifel's observations show that phosphorus in the oil is converted into phosphoric acid. Chronic intoxication (phosphorism), observed in match factories and in those exposed to the fumes of phosphorus, develops the following: anemia, emaciation, garlicky breath, albuminuria, diarrhea, and necrosis of the maxillæ. Carious teeth predispose to intoxication.

Picric Acid.—Used extensively in the treatment of burns, and used by malingerers in Germany to escape military duty by creating the impression that they have icterus, poisoning may occur. Symptoms: vomiting, diarrhea; yellowness of the skin, mucous membranes, and urine; convulsions, and collapse.

Potassium Chlorate.—Taken internally in large doses, this drug has often produced fatal results. The symptoms are referable chiefly to the blood and kidneys. It converts hemoglobin into methemoglobin, resulting in decolorization and destruction of the red cells. Cyanosis, vomiting, purging, albuminuria, and heart depression are frequent symptoms. Some years ago[12] I reported a case of poisoning in a three-year-old child who had swallowed thirty 3-grain lozenges of chlorate of potash in the belief that they were candies (medicinal lozenges are frequently mistaken for candy by children). Vomiting followed and twelve lozenges were expelled. On the following day blood was passed in the urine and the patient suffered from abdominal pains. Cyanosis became marked. Almost complete anuria existed, and on the sixth day uremia developed, with slight elevation of temperature. Cyanosis was succeeded by icterus. Death occurred on the tenth day. Insomuch as this drug is practically a specific in ulcerous stomatitis, the benefit arising supposedly from its elimination in the saliva, there is no reason for its internal use when it can be used locally in a variety of ways.

Quinin.—The toxic symptoms of this drug are closely associated with its physiologic action, and are desirable when the full effects of the medicine are sought, for no authentic death has ever been attributed to the drug. Cinchonism is characterized by ringing in the ears, fullness in the head, dimness of vision, irritability of the bladder, and cutaneous eruptions which are usually erythematous. Even trivial doses in susceptible persons will develop cinchonism. One of my patients who was taking five grains of the drug three times a day developed a rash resembling scarlatina, which was followed by diffuse desquamation. Quinin rashes may be attended by intense itching, which may be universal or limited to the hands, legs, or glans penis. A quinin-exanthem may resemble that of *scarlatina*, and Morrow observes that many recorded cases of recurrent attacks of that disease and measles are often only instances of a quinin-exanthem. Examination of the urine for quinin (*q. v.*) will determine the nature of the eruptions. The injurious effects on sight and hearing may be permanent. Aside from local symptoms (lacrimation, photophobia, etc.), loss of vision in one or both eyes, usually temporary, may occur, due to constriction of the retinal vessels. A persistent and typical lesion, even without visual impairment, is a concentric limitation of the field of vision. Deafness from quinin may persist for hours, and a pre-existing middle-ear disease may be aggravated.

Grant notes that the tinnitus is caused by congestion of the labyrinth, and can be quieted by compression of the vertebral arteries. The latter diminishes pressure in the basilar artery, its branches in the internal auditories, and thereby in the vessels of the labyrinth. This compression may be made in the suboccipital region, the thumb and finger of one hand being placed in the hollows behind the mastoid process, while counterpressure is made by the other hand on the forehead. As the arteries lie under the complexus muscle, the pressure must be rather firm. If such pressure checks pulsating noises or vertiginous feelings, the inference is, that these are due to congestion in regions supplied by the branches of the basilar artery, probably the internal ear. If noises in the ear are diminished by compression of the carotid artery, they are probably caused by congestion of the arterioles in the middle or external ear, and are often synchronous with the pulse. In anemia and chlorosis the venous hum (*bruit de diable*) is often a subjective noise. It is loudest in the erect posture and during inspiration; it is also intensified when the head is turned far to one side, a maneuver which constricts the vein. Quinin in small doses may precipitate a typic malarial paroxysm in individuals suffering from malaria. Such symptoms are known as quinin fever.

Samuel Hahnemann's homeopathic theory of *similia similibus curantur* was founded on this untoward effect of quinin. Hahnemann at one time had malaria, and suffered from no attack for many years, until one day he tried the effect of cinchona upon himself for experimental purposes. The ingestion of the drug was followed by a violent rigor and a well-marked attack of ague, and thus he argued: if cinchona is a remedy for ague, and if in me it has precipitated an attack of the disease, it must follow that a small dose of the drug which produces certain symptoms will cure the same symptoms when they are caused by the disease. Another tenet of his doctrine, that of attenuation, was founded on an equally erroneous observation. He noted that a small quantity of mercury by trituration becomes more and more powerful, but he did not know that when mercury is triturated for a length of time, it is first changed into a mercurous, and later into a mercuric, oxid. Again, quinin in small doses may cause bloody urine in malarial individuals, and the hematuria may disappear after the administration of large doses. No explanation is offered for such curious phenomena. Late investigators show that quinin alone is responsible for the hemoglobinuria following the administration of this drug.

Prophylaxis.—Women and aged subjects are susceptible to quinin, whereas individuals with delicate skins are prone to quinin exanthemata. The cutaneous symptoms, notably urticaria, are more prone to occur when the drug is taken on an empty stomach. It is claimed that atropin will inhibit the cutaneous manifestations of quinin. In aural and ocular affections the drug must be used cautiously or avoided. Its objectionable taste has led to its administration in capsules and pills. The latter are objectionable because quinin is absorbed chiefly from the stomach, and the pills leave that organ before the drug is liberated. Euquinin is a tasteless quinin made by Merck, and has the same therapeutic indications and dose as quinin without the disagreeable effects on the stomach, and the toxic symptoms are said to be moderated. It may be given in sherry, milk, soups, cocoa, etc. The taste of quinin may be disguised by elixir of licorice or the syrup of yerba santa. The tannate, possessing half the strength of the sulphate, of quinin is often given to children in the form of chocolates. Cinchonism is an indication for temporary withdrawal of the drug. Among drugs suggested for preventing cinchonism are the bromids, hydrobromic acid, and ergotin. Any one of them is given coincidentally with quinin. Perhaps the bromids are the most efficient drugs for inhibiting cinchonism, and for this purpose it is customary to use 3 grains of bromid for every grain of quinin prescribed.

Salicylates.—The symptoms are not unlike those of quinin. They irritate the alimentary canal and retard digestion. The greenish discoloration of the urine is supposed to be due either to indican or pyrocatechin. Kidney irritation may be sufficient to cause albuminuria, hematuria, or even nephritis. There is reason to believe that many of the toxic symptoms, notably cardiac and respiratory depression, are caused by impurities in the marketed drug.

Prophylaxis.—The salts of salicylic acid are less irritating than the acid and are generally employed for internal use. They must be used cautiously in nephritis and the urine must be carefully watched. No external application can substitute the internal use of the salicylates. I have never observed a single patient who could not tolerate the salicylates if given in moderate doses well diluted after meals. One has a right to question the reliability of a preparation which fails to induce tinnitus in moderate doses. I have never observed the least effects from the external use of the salicylates, especially the marketed preparations that are vaunted for the easy introduction of the salicylates into the body through the skin. Frey[210] notes that when the urine is alkaline, there is no irritating action of the salicylates on the kidney, and if irritation follows, it is caused by the liberation of free salicylic acid; hence, alkalies should always be given with the salicylates to prevent acidity of the urine.

Salol (Salophen).—Salol consists of salicylic acid (60 per cent.) and phenol (40 per cent.). It has been introduced as a substitute for salicylic acid, and while it is less apt to derange digestion and induce toxic symptoms, the carbolic acid which it contains has caused carbolic acid intoxication. Salophen has been introduced as a substitute for salol on account of the carbolic acid contained in the latter drug. Neither drug can substitute the salicylates in rheumatism.

Silver.—As the nitrate, this silver salt was at one time extensively used in the treatment of epilepsy, locomotor ataxia, and other nervous affections. At present it is supposed to have some problematic value in gastric catarrh and ulcer. One is not justified, however, in running any risk with its internal use. Its long-continued administration may result in the deposit of metallic silver in the different tissues, leading to a bluish-gray or grayish-brown discoloration of the skin and mucous membranes (argyria), which is usually permanent. Even the local applications of the salts (in nose, throat, eye, and urethral affections) may lead to this general pigmentation. Lavage of the stomach and large intestine with argentic preparations has been followed by argyria. In Neumann's case only twelve washings of the stomach with dilute solutions (1.45 gm. of the salt to 90 of water) sufficed to induce an intense argyria. Localized argyria may follow the use of nitrate of silver applications to mucous membranes or wounds, and, like the universal form, is almost invariably permanent. Laborers who cut or polish silver may develop disseminated localized argyria due to silver particles which have penetrated the skin, or from the inhalation of a silver-dust-laden atmosphere. Such spots are likewise permanent.

Prophylaxis.—There is only one effectual way of avoiding argyria, and that is, not to use the salts of silver. If they must be used in deference to tradition, treatment should be interrupted from time to time. After the local use of silver, dust, paint, or spray the part treated with common salt, which forms an inert and insoluble silver chlorid.

Strychnin.—We are not here concerned with the toxicology of the drug, but to determine when it should be stopped when given for therapeutic purposes. The primary indications for withdrawing the drug are: nervous excitement, restlessness, exalted sensibility of touch, sight, and hearing, and some anomaly of the senses, such as color vision, constricted chest feeling, with anxiety, dysphagia, and twitching of the muscles. The latter usually begins in the fingers, and the curious fact is noted that when given to a paralytic, the twitching is first observed in the paralytic and not in the sound limb. We must not forget that strychnin, unlike tetanus, involves the muscles of the jaws (trismus) as a late phenomenon. The drug has a cumulative action owing to its slow excretion.

Sulphonal (Trional, Veronal).—These drugs have effects in common. In acute poisoning the following are noted: vertigo, tinnitus, headache, cyanosis, vomiting, diarrhea, dilated pupils, and unconsciousness. In a recent case of veronal poisoning which I observed the coma was even more pronounced than in any case of opium poisoning I ever witnessed.

In chronic poisoning from the continuous use of the drugs in question an important symptom is the passing of a port-wine colored urine, due to the presence of hematoporphyrin. They all have a destructive action on the red blood-cells, and lead to cyanosis, ecchymoses, and degenerative visceral changes. Paralyses, nephritis, and ataxia have been observed. Some years ago I had occasion to prescribe a 10-grain dose of trional for a patient who suffered from insomnia. She had never taken a hypnotic before. On my visit the following morning I found a well-developed hemiplegia, which persisted until her death about three years later. In this instance the paralysis would have occurred anyway, whether she had or had not taken trional. A very serious tome could be indited on "Coincidences in Therapeutics." I was about to puncture the pleura for the removal of an exudate when the patient suddenly died. Had I even touched the skin with the needle, the relatives of the patient would have held me responsible for his death. Some years ago a colleague sent a patient from the country to my office for an examination. The latter had angina pectoris. Before I began my examination, the patient died suddenly.

Suprarenal Extract (Adrenalin).—This valuable drug has not only been used, but, like all good things, it has been misused. Cases of glaucoma have followed its use in ophthalmic practice. Dropped in the eye, it produces superficial ischemia, but congestion of the deeper parts. In cases reported by Senn[13] and Brav[14] the effects were immediate, the pupils dilating with increased ocular tension. Extreme mydriasis, corneal opacities, interstitial infiltration, and edema of the lids have also been noted. The deductions drawn from the toxic action of adrenalin are based largely on experimental investigations on animals, and it is yet too early to confirm such results clinically. Glycosuria may follow its use, and the arterial hypertension long maintained may give rise to adrenalin atheroma.

Prophylaxis.—It must not be used in cataractous eyes which are predisposed to glaucoma. Deep-seated ocular affections, owing to the congestion produced there by adrenalin, contraindicate its use. Brav advises even against its use in corneal lesions, for the reason that corneal nutrition necessarily suffers, owing to the diminished blood-supply. Ball[15] asserts that even in conjunctival injections its effects are only temporary, and the inflammation returns with a force equal to or greater than before. It should be interdicted in elevation of blood-pressure, in arteriosclerosis, and in aneurism. It should not in any event be used uninterruptedly, but discontinued at least one day in every week. No ill effects have been noted to follow its local application to the nasal mucosa. It was supposed that potassium iodid was effectual in preventing the development of arteriosclerosis if given simultaneously with suprarenal preparations, but Koranyi, who was responsible for the foregoing, subsequently admitted that he was mistaken in his conclusions.

Thyroid Extract.—The symptoms (thyroidism) resemble those of exophthalmic goiter; in fact, the latter affection has been produced by this extract. The symptoms are: anorexia, nausea, nervous excitement, insomnia, headache, heart palpitation, tachycardia, perspiration, dyspnea, tremors and twitchings, rise of temperature, prostration, progressive loss of flesh, optic neuritis, pruritus, delirium, loss of hair, dilatation of pupils, vertigo, syncopal attacks, numbness of the fingers and toes, rashes, paralyses, etc. The thyroid gland has been observed to enlarge during thyroid treatment. Young children taking thyroid preparations grow rapidly and may develop scoliosis and kyphoscoliosis, and cretins may show rickets. Under thyroid treatment, glycosuria has occurrred, persisting until treatment was suspended, and in a case of Ewald's it persisted and suggested diabetes mellitus.

Prophylaxis.—Thyroid preparations should be administered in small and ascending doses and suspended at least temporarily on the advent of thyroidism. Arsenic combined with thyroid preparations in small doses is said to counteract the latter. Cardiac weakness suggests the use of small doses prescribed cautiously. In renal disease and glycosuria the preparations should likewise be used cautiously and the urine examined frequently. In the use of the preparations for obesity, the heart must be examined frequently to avoid the danger of heart collapse. The use of the thyroids accentuates the symptoms of exophthalmic goiter.

Tobacco.—Nicotin, the active principle (1 to 8 per cent.), is in combination with citric and malic acids.

Acute Tobacco Poisoning.—Nausea, vertigo, vomiting, clammy sweating, tremor, and prostration.

Chronic Tobacco Poisoning.—Irritation of the respiratory tract with catarrhal inflammation of the nose, throat, Eustachian tubes, etc. The most pronounced effects are on the heart, which lead to functional disturbances. Some writers claim that it causes arteriosclerosis. Irritability and palpitation of the heart are common, as well as pains in the precordial region, chiefly located around the left nipple. Examination of the organ may demonstrate nothing beyond irregularity. The pulse is more rapid, especially on sudden change from sitting to standing. Huchard regards tobacco as a potent cause of true angina pectoris, but others, in fact, the majority, contest this statement. The following are associate symptoms of tobacco angina, according to Huchard: pallor, vertigo, small, irregular, and rapid pulse, and syncope. Tobacco amblyopia is generally conceded, although the coincident action of alcohol is difficult to exclude. Many of the other effects ascribed to tobacco are conjectural, viz., impotency, glycosuria, neuritis, locomotor ataxia, and even insanity. Those of erethistic temperament are more easily affected by tobacco than are the phlegmatic, and the sedentary brain-worker cannot with impunity smoke as much as he who leads an active outdoor life. In habitual smokers, at the inside of the mouth and lips, opalescent areas, known as the milky patches of smokers, may appear, which may be mistaken for syphilitic patches. Erb has directed attention to the influence of tobacco on *claudication.*

Prophylaxis.—Tobacco must be interdicted, temporarily at least, in affections of the mouth, nose, throat, or in symptoms arising from the heart and nervous system. The smoke should not be inhaled. Strong tobacco must be avoided. Cigars should not be smoked to the end, chewed, or held too long in the mouth. The cigar should be shifted from one side of the mouth to the other to avoid local irritation. If a pipe is used, a clean clay pipe absorbs the poison and is safer than a short dirty pipe. A pipe with a long stem is safer than one with a short stem. The pipe, cigar, or cigarette-holder must be cleaned daily. One is too ready to advise discontinuance of tobacco, for the latter is supposed to represent a multitude of evils more fanciful than real. Tobacco soothes and is not harmful to the average healthy individual when used in moderation. It is the abuse and not the use of tobacco which is injurious. A cigar after meals minimizes the danger of poisoning, and it is asserted that a water-pipe effectually antagonizes intoxication. A large number of smokers are only creatures of habit. In a dark room or with blindfolded eyes, it is impossible for them to tell whether they are smoking a lighted or unlighted cigar, hence such are more influenced by seeing the smoke than by feeling the effects of tobacco. It is claimed that the habit may be broken by washing the mouth with a 25 per cent. solution of nitrate of silver or painting the tongue and palate with a solution of the same drug (1 to 5 per cent.): the taste of tobacco is said to be repugnant after either maneuver. A little cotton inserted into the cigarette- or cigar-holder will diminish the local irritating effects of the tobacco smoke.

Denicotinized tobacco is now made for those who are unable to forego the habit. The preparations thus far made have not come into general favor. Recently the French government has marketed a variety of caporal (*caporal doux*) which is very satisfactory. Experiments made with this nicotinless tobacco demonstrate that arteriosclerotic lesions of the aorta cannot be provoked in rabbits, whereas infusions of ordinary caporal cause the development of such lesions.

Zinc.—Poisoning by zinc produces symptoms similar to those of copper poisoning (see p. 65), though less pronounced.

Carbonic-acid Gas (Carbon Dioxid).—Obscure symptoms frequently owe their genesis to badly ventilated sleeping-rooms, and recovery from sickness is retarded when the sick-chamber is improperly aired. Among the symptoms of carbonemia are: feeling of a sense of closeness, fullness in the head, pressure in the temples, giddiness, singing in the ears, somnolence, nausea, and muscular weakness. A foreign minister in Washington had a protracted illness. In despair he sent for a new physician, who told him to take the medicine in a suitable "vehicle" after each meal. After the physician's departure he sought in the dictionary for the meaning of "vehicle," and found it was a carriage. Obeying the physician, as he thought, he took a ride after each meal, and to his great pleasure speedily recovered. We determine a vitiated atmosphere by its odor, but we rarely resort to a definite test to determine the degree of vitiation. A well-ventilated room should not contain more than 0.6 per 1000 of CO_2.*

Smith's Minimetric Method.—Procure six clean, dry flasks provided with tight-fitting rubber stoppers. The flasks have respectively a capacity of 150, 200, 250, 300, 350, and 400 c.c. Pour into each flask 15 c.c. of fresh lime-water and agitate for several minutes; the smallest flask showing turbidity indicates the proportion of carbon dioxid present, according to the following table:

CAPACITY OF FLASK.		PARTS OF CO_2.
150 c.c.	indicates	1.6 in 1000
200 c.c.	"	1.2 in 1000
250 c.c.	"	1.0 in 1000
300 c.c.	"	0.8 in 1000
350 c.c.	"	0.7 in 1000
450 c.c.	"	0.5 in 1000

In affections of the respiratory apparatus, where fresh air is a desideratum, I instruct the attendant to procure one flask of 300 c.c., and if the lime-water in this shows turbidity, provision must be made for more fresh air.

Carbon Monoxid.—The conventional sources of this gas are open charcoal or stove-coal fires, defective stove-pipes or furnace flues, and the escape of illuminating gas; the hot-air furnace, which is in common use, furnishes many cases of chronic poisoning. Symptoms: headache, vertigo, nausea, anemia, languor, debility, and bronchial irritation, which in children may eventuate in capillary bronchitis. The symptoms often suggest malarial infection. Test: Spectroscopic is the best, but the following may suffice in emergencies: To a little blood in a porcelain dish, add a small amount of a 10 per cent. solution of caustic soda or potash and warm gently. In the presence of sufficient quantity of the gas the mixture becomes a brilliant red; normal blood turns to a dirty greenish-brown. Control test by examination of normal blood. Poisoning may exist without its demonstration by this test.

A more recent test[30] is the following: Mix 2 c.c. of blood with 4 c.c. of an 8 per cent. solution of hydrochlorate of quinin. Heat gently to boiling, and when slightly cool, add 3 drops of perfectly fresh ammonium sulphid; next shake mixture, and if carbonic oxid is present, a clear red color results, whereas normal blood turns a dirty brownish-green.

Hydrogen Sulphid.—This is generated in the presence of putrified organic matter, hence insalutary toilets frequently give rise to poisoning. In the industries where sulphur is used and this gas is manufactured, intoxication occurs. Symptoms: languor, vertigo, nausea, emesis, head-pressure, muscular twitchings, dyspnea, etc. The following test is very sensitive, but only succeeds with the SH_2, which is not chemically bound in the blood: P-Aminodimethylanilin in infinitesimal quantity is dissolved in acidulated water to which a little iron chlorid is added. The merest trace of SH_2 turns the solution blue.

We will now proceed to summarize the diseases that are provoked by drugs. Symptomatic affections have been excluded as far as possible in the summary.

ANALECTIC REVIEW OF DRUG DISEASES.

ABORTION produced:

(1) By Emmenagogues:

- Apiol.
- Cantharides.
- Myrrh.
- Oxalic acid.
- Pennyroyal.
- Pulsatilla.
- Rue.
- Salts of manganese.
- Savin.
- Senecio.
- Tansy.

(2) By Oxytocics:

- Corn smut.
- Cotton-root bark.
- Ergot.
- Hydrastis.
- Quinin.

ANEMIA.

- Acid, boric.
- Lead.
- Mercury.

ARTERIOSCLEROSIS.

Adrenalin. Alcohol. Ergotin. Lead. Tobacco.	Act by increasing peripheral resistance in the smaller vessels and thus raising blood-pressure. Loeper and Boveri[222] have produced aortic atheroma experimentally by tobacco and ergotin.

ASTHMA.

Coffee, freshly roasted; Ipecac, powder of; Peru, balsam of; and Tobacco.	The odor of these substances may induce in susceptible persons an asthmatic paroxysm. Preliminary phenomena, even though no asthma is produced, may be: sneezing, lacrimation, and running from the nose.

BRADYCARDIA (Slow Heart).

Alcohol. Carbon dioxid. Coffee. Digitalis. Glucose. Lead. Opium. Tea. Tobacco.	These substances are likewise etiologic in other cardiac neuroses, like arhythmia, palpitations, tachycardia, etc.

CYANOSIS.

Coal-tar products: Antipyrin, Acetanilid. Hydrocyanic acid. Calcium chlorid. Nitrobenzol.	By inducing chemical changes in the blood.
Opium and its products:	By depressing the respiratory centers.

DIABETES MELLITUS.

Amyl nitrite. Benzol. Carbon monoxid. Corrosive sublimate. Chloral hydrate. Curare. Morphin. Nitrobenzol. Oil of turpentine. Phloridzin. Thyroid preparations.	Diabetes mellitus signifies the permanent, and glycosuria the temporary, presence of sugar in the urine. Usually these drugs produce only glycosuria, although in the use of thyroids sugar has persisted. The reaction of some of these drugs depends on the presence of *glycuronic acid*. *Renal diabetes.*—Glycosuria may occur after the use of diuretics (theobromin, caffein), but in such instances there is no hyperglycemia. Nephritis associated with diabetes is usually secondary to the latter, and the glycosuria diminishes as the nephritis develops (so-called cure by Bright's disease).

EPILEPSY.

Alcohol. Belladonna. Camphor. Ergot. Lead.	Chronic alcoholism in the parents is a cogent predisposing factor. In 572 cases analyzed by Echevarria, 257 cases could be directly traced to alcohol as a cause. Epileptic convulsions may occur in habitual drunkards. Plumbism should always be thought of in epilepsy occurring in adults. In plumbism true epilepsy may succeed convulsions.

EPITHELIOMA.

Arsenic.	A collection of 11 cases occurring in psoriasis and evidently caused by the continuous use of this drug (Hartzell). Other cutaneous lesions produced by this drug are characterized by augmented cellular proliferation.

ESOPHAGUS, AFFECTIONS OF.

Corrosive poisons.	Stricture and acute esophagitis are the usual affections produced by such drugs. After the prolonged administration of tartar emetic, a pustular esophagitis was noted by Laennec.

GANGRENE.

Carbolic acid. Caustics. Collodion. Ergot. Phosphorus.	Certain conditions predispose to gangrene, and drugs are merely the exciting cause: spinal affections, diabetes, arteriosclerosis, enfeebled heart, etc. Among the early symptoms of gangrene are: anesthesia, arrest of circulation, fall of temperature, loss of function, and change in color. Test of vitality in a part: the prick of a pin is not felt in the anesthetic or dead tissue, but if it is grasped with a forceps, the traction upon the adjacent inflamed living tissues will be very painful (Gould). I know of one instance where collodion applied to the toe was followed by gangrene. The collodion was so applied around the toe that it obstructed the blood-supply.

GASTRITIS, TOXIC.

Caustic acids and alkalies, Arsenic, Phosphorus, and other irritant drugs.	Usually ingested in consequence of accident or with suicidal intent. A variety of this toxic condition is alcoholic gastritis. Catarrh of the stomach is usual in habitual drinkers. Beer-drinkers suffer from dilatation of the stomach.

GLAUCOMA.

All mydriatics increase, Adrenalin, Atropin, Cocain, Duboisin, Euphthalmin, Homatropin, Hyoscyamin, Hyoscin, Scopolamin; and myotics diminish, intraocular tension: viz., Eserin and Pilocarpin.	Mydriatics must be used cautiously in persons having a tendency to glaucoma and in persons past middle life whose tension is increased. To test tension: Have patient look down and gently palpate the closed lid at the scleral junction of the cornea by means of the index-fingers, like testing for the fluctuation of an abscess. The tension of a normal eye is used as a basis for comparison. The early symptoms of glaucoma are: vision is obscured, rainbow tints are seen around lights, the cornea at its center is slightly cloudy, due to edema (is the cause of the preceding signs), pain in the eye and head, dilated and slowly reacting pupil, and increased tension of the globe. These symptoms may be intermittent, and in the interim the eye may present a normal appearance. A rapid increase of presbyopia creates suspicion of glaucoma.

GOUT.

Alcohol. Lead.	Gout is hereditary in about half the cases. Alcohol and lead may be merely exciting factors or act independently of heredity. Fermented liquors (heavy English and Scotch ales) favor the disease more than do the distilled spirits. In 30 per cent. of Garrod's cases of gout (hospital cases) the patients were painters or workers in lead. Gouty deposits in plumbism may be detected in the big-toe joint, but typic paroxysms of gout are rare in lead-workers in the United States.

HYSTERIA.

Alcohol, Morphin, and other drug habits.	Many drug habits, notably alcoholism and morphinism in both sexes, notably women, may be hidden by the prevailing symptomatic complex of hysteria or neurasthenia.

IMPOTENCY.

Alcohol. Belladonna. Bromids. Camphor. Circulatory depressants. Hyoscyamus. Opium and derivatives. Stramonium. Tobacco.	Other drugs are regarded as *anaphrodisiacs*, such as lupulin, the iodids, salicylic acid, etc., but their action in this respect is questionable. We must not fail to differentiate the action of these drugs from the diseases for which they are given, which likewise contribute to the etiology of impotency, viz., neurasthenia, diabetes, obesity, Bright's disease, locomotor ataxia, etc. Alcohol in moderate doses is more often an aphrodisiac, hence the aphorism, *Sine Baccho friget Venus.*

INTESTINE, OBSTRUCTION OF.

Bismuth. Magnesia.	Long-continued use of these drugs may cause obstruction by accumulating in the bowels.

JAUNDICE (Icterus).*

Antimony. Arsenic. Chloral hydrate. Chloroform. Copper. Ether. Mercury. Phosphorus. Potassium chlorate. Toluylendiamin.	The toxemic icterus thus produced is caused by the destruction of the red blood-cells by the circulating poisons. I have seen several cases of the obstructive form of icterus, the result of gastro-duodenal catarrh, induced by the ingestion of irritant drugs improperly diluted and continued beyond their physiologic action. This was especially noted after the use of arsenic.

1, LARYNGITIS, and 2, LARYNGEAL EDEMA.

1. Alcohol, Inhalation of irritating gases (ammonia, chlorin, iodin, sulphur), Ozone inhalations, Potassium iodid, and Tobacco. 2. Represents a more intense action of the foregoing.	In some persons even trivial doses of iodid will result in laryngitis which evanesces on disuse of the drug. Too vigorous treatment by the specialist with strong solutions of silver nitrate may eventuate in edema. I have known the ingestion of hot liquids to act similarly.

LIVER, AFFECTIONS OF.

Alcohol. Arsenic. Chloroform. Phosphorus.	Alcohol is responsible for hyperemia and cirrhosis of the liver. The others, for fatty degeneration and acute yellow atrophy. The latter has been known to follow a drinking bout (Osler). Strong spirits are more potent etiologic factors in cirrhosis than malt liquors. In France, the *vin ordinaire* is a frequent cause of cirrhosis.

MALARIA, HEMORRHAGIC.

Quinin.	In the tropics malarial hemoglobinuria (blackwater fever) is common. By some it is supposed that this drug may bring on an attack of hemoglobinuria in malarial subjects. Others deny this statement, though they admit that large doses of quinin may aggravate a paroxysm.

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* One of the most sensitive reactions for biliary pigments is the following: To the urine neutralized with sodium carbonate, 10 drops of a 20 per cent. solution of calcium chlorid are added. The precipitate is filtered and washed and then dissolved in 3 c.c. of alcohol containing hydrochloric acid. After heating the solution, to which has been added a drop of a 0.5 per cent. solution of sodium nitrite, a greenish color ensues.

NEPHRITIS (toxic).

(Hemoglobinuria);
Arseniureted hydrogen,
Balsam of Peru,
Carbon monoxid,
Carbolic acid,
Chlorate of potash,
Lead,
Pyrogallic acid,
Mercury,
Muscarin,
Naphthol,
Quinin,
Sulphonal,
Trional,
Urotropin.

These substances exert their influence on the kidneys by use externally or internally. They primarily induce degenerative changes in the renal epithelium, to be followed later by inflammation of the organ (nephritis). Hemoglobinuria means only the destruction in the blood of the red cells and the escape of the pigment by the kidneys. Sulphonal and trional, especially in women, and lead, cause hematoporphyrin to appear in the urine, imparting a very dark color to the latter. Its occurrence suggests the immediate discontinuance of sulphonal and trional and the giving of alkalies and purgatives.

Hematuria has frequently followed the use of urotropin, and the presence of red blood-cells in the urine may precede the development of toxic symptoms of the drug in question. Strangury and bladder irritation have also been noted.

NEURITIS.

1. Localized neuritis,
   Ether.
2. Multiple neuritis,
   Alcohol,
   Arsenic,
   Bisulphid of carbon,
   Copper,
   Ether,
   Lead,
   Mercury,
   Naphtha,
   Phosphorus,
   Zinc.

1. This form has followed the hypodermic injection of ether. During anesthesia the abnormal posture of an extremity may lead to neuritis from pressure.
2. In chorea the use of arsenic has frequently been followed by neuritis. In arsenical poisoning the nails show transverse ridging and sometimes white lines running across them (leukonychia). Osler mentions a case of neuritis following the use of sulphocarbolate of zinc, two grains of which were taken daily for three years. Among rare causes are: coffee, tea, and tobacco. The use of inunctions of mercury has caused neuritis.

NEURITIS, OPTIC.

Alcohol.
Arsenic.
Bisulphid of carbon.
Iodoform.
Lead.
Nitrobenzol.
Tobacco.

Usually alcohol and tobacco act together. Wood-alcohol used to adulterate cheap whisky is especially harmful. The progress of the affection is usually slow, beginning with diminution in the acuteness of sight; foggy vision and sight disturbances are more marked in bright light. Presence of *scotomata* is important in diagnosis. Test for same: let patient, with one eye closed, look steadily at tip of physician's nose at a distance of about two feet; then take any green or red colored object (wool or cardboard), about 2 to 5 mm. in diameter, and move it from the periphery to the point of fixation; when the object arrives at the scotoma (seat of defect in the visual field) it will appear dull or colorless. Green is usually less readily perceived than red. It is wise to know this simple test, for disuse of tobacco or alcohol may restore vision to the normal.

PARALYSIS.

Anesthetics,
Bromids,
Colchicum,
Ergot,
Lead,
Mercury,
Sulphonal,
Thyroids.

Here the paralysis is of varied origin: (1) Pressure palsies due to anesthetics. (2) Palsies from neuritis (lead and mercury). (3) Contraction of the arteries and degeneration of the spinal cord (ergot).

PAROTITIS.

Copper
Lead,
Mercury,
Potassium iodid.

The parotid and submaxillary glands may be equally inflamed or simply enlarged. After withdrawal of the drugs, the glands usually resume their normal condition.

PSYCHOSES, TOXIC.

Alcohol,
Cocain,
Opium.

Nearly every drug, especially narcotics (ether, chloroform, chloral, cannabis), coal-tar preparations (antipyrin, phenacetin), quinin, belladonna, salicylic acid, etc., may produce mental effects, notably, acute hallucinatory confusion. Alcohol is responsible for delirium tremens, a pseudoparesis, epilepsy, acute hallucinosis, pseudoparanoia, and dream states.

PURPURA.

This symptomatic condition, which is essentially an extravasation of blood into the skin, may be caused by any of the drugs enumerated in the list causing toxic nephritis (*q. v.*). The iodids are especially followed by petechiæ (blood extravasation in spots), even after small doses. The petechial rash may be preceded by erythema and may be accompanied by febrile symptoms.

1, TETANY; 2, TETANUS.

1. Alcohol.
   Chloroform.
   Ergot.
   Lead.
   Morphin.
2. Strychnin.

This condition, characterized by paroxysmal or continuous spasms in definite muscle groups, may be caused by any of the drugs here listed. Like many other drugs, it is quite likely that they are merely exciting factors. Strychnin poisoning presents a clinical picture not unlike that of tetanus but in the former rigidity of the jaw muscles is a late phenomenon, and between the paroxysms the jaw muscles are relaxed.

VERTIGO.

Anesthetics,
Belladonna,
Cocain,
Cannabis indica,
Digitalis,
Lead,
Potassium iodid,
Quinin,
Salicylates.

Toxic vertigo may also be caused by diseases (specific fevers, gout, malaria, uremia) and the abuse of tea, coffee, alcohol, and tobacco.

VISUAL DISTURBANCES.

Alcohol.
Digitalis.
Jaborandi.
Male-fern.
Quinin.
Salicylic acid.
Santonin.
Spigelia.
Tobacco.

The yellow vision (xanthopsia) of santonin, even in therapeutic doses, may be due to staining of the eye humors. Spigelia may diminish the vision temporarily. Male-fern (filix-mas) may produce temporary or permanent blindness, due to degenerative changes in the optic nerves. Digitalis may obscure sight, and yellow vision has been noted.

III. FOOD IN THE ETIOLOGY OF DISEASE.

The psychology of eating is a prolific subject. Sir William Roberts has referred to the palate as the dietetic conscience, and Dr. Allison said: "Let me diet a person and I can give him almost any kind of disease known—long life or short life." "To eat little," said Cornaro, "and that little of simple food, is to prolong life." The majority of people dig their graves with their knives and forks, and Dr. Abernethy observed that there is no beast of burden in the world so overloaded as the human stomach. Every farmer knows the influence of the quality and quantity of food on his animals, and I cannot help recall the observation of Voltaire: "If as much care were taken to perpetuate a race of fine men as is done to prevent the mixture of ignoble blood in horses and dogs, the genealogy of every one would be written on his face and displayed in his manners." "Many a man," said Talmage, "is trying to do by prayer what can only be done by a correct diet." I believe it was a Carlylian observation that the average American meal was an unpunished crime. "Fortunate is the patient," says Dr. James Arneill, "whose advice comes from a man with a normal alimentary tract." The personal factor in the relation to food is so important that the best physician is he who disregards self and studies human nature objectively, with a view of studying all the idiosyncrasies of his patient in relation to his health. Correct eating (euphagia) embraces the following: (1) How much to eat; (2) What to eat; (3) How to eat; (4) When to eat.

1. **How Much to Eat.**—Mott observed that if a medieval devil were desirous of discovering the most subtle and expeditious method of exterminating mankind mentally, morally, and physically, he would have employed every means to tempt and pervert their appetite. I doubt whether most persons really know how much they do eat. On this point they can gain precise information if they will put into a receptacle the same quantity of food they put each time into their mouths. An experiment like the foregoing will be sure to gain more converts to the gospel of moderation than all the scientific exhortations of dietists. It is not always so much what we eat, but what we can digest; and what cannot be digested is the contributory revenue of gout, rheumatism, and innumerable diseases.

Classification of Food.—1. Proteid or albuminous (eggs, meat, gluten of bread, etc.). They contain about 16 per cent. of nitrogen.

2. Carbohydrates (sugar and starches).
3. Fats of animal and vegetable origin.
4. Salts and water.

Caloric Value of Food.—Ingested food subserves not only the purpose of repairing tissue waste, but furnishes also energy for muscular movements and for bodily heat. To attain the former object, the character of the food is most essential, whereas the latter object can be achieved by any of the foregoing foods, provided it is sufficient in quantity. Almost the entire energy of the food leaves the resting body as heat, and the heat thus produced by bodily consumption differs in no wise from the burning of the same food outside of the body to the same waste products. Heat is measured in calories, and the heat unit is called a calorie, which represents the amount of heat necessary to raise the temperature of one kilogram of water one degree Centigrade. Expressed in energy, a calorie is equivalent to the work necessary to raise 425 kilograms one meter in height. Different food-stuffs liberate different quantities of heat:

1 gram of fat produces	9.3 calories
1 gram of carbohydrates produces	4.1 "
1 gram of proteids produces	4.1 "

It will be noted from the foregoing that one gram of fat furnishes the same energy as 2.3 grams of the other food-stuffs.

It is possible to determine whether any given diet will furnish sufficient energy for the caloric requirements of the particular individual. In an adult of average nutrition and size the number of calories necessary per kilo of body-weight is as follows (Moritz):

	CALORIES.
Resting in bed	30–34
Quiet out of bed	34–40
Moderate work	40–45
Hard work	45–60

Children need relatively more food than adults, for the reason that a small body loses more heat in comparison to its weight, on account of its relatively large surface. Obese individuals require relatively less food for several reasons: (1) A large body has relatively a small surface. (2) The fat prevents heat losses. (3) Fat individuals take little exercise. (4) The fat of the individual does not consume energy. According to the accepted dietary standard of Voit, a man engaged in moderate work requires:

118 grams of proteid food,
56 " " fat,
500 " " carbohydrates.

This diet (fuel value) is equivalent to 3055 calories or heat units per day. Voit increases the daily requirements with hard work to:

145 grams of proteid,
160 " " fat, and
450 " " carbohydrates—3370 calories.

The proteids are the only true tissue builders and repairers. Muscles and other tissues are essentially made up of proteids, and only the nitrogen-containing proteids will build such tissues. The energy yielders are carbohydrates, and proteids and fats have twice the value of either of these. Naturally, the food requirements vary. The following table by Atwater represents standards for American dietaries:

	PROTEID (in Grams).	FUEL VALUE (in Calories).	NUTRITIVE RATIO.
Woman with light muscular exercise	90	2400	1 : 5.5
Woman with moderate muscular work Man without muscular work	100	2700	1 : 5.6
Man with light muscular work	112	3000	1 : 5.5
Man with moderate muscular work	125	3000	1 : 5.8
Man with hard muscular work	150	4500	1 : 6.3

More recent investigations concerning food requirements show that men may live and thrive on amounts of proteid per day equivalent to one-half the amount called for in the Voit standard. Assuming even that the Voit standard is correct, the majority of us eat in excess of our requirements. Let us treat the matter more concretely. At rest a man needs about 40 calories per kilo (2.2 pounds avoirdupois) of body weight. A man weighing 60 kilos would then need 2000 calories in twenty-four hours, and he would have to ingest the following amounts to meet such requirements:

Albumin	50 grams	= 200 calories
Fat	50 "	= 450 "
Starch or sugar	400–500 "	= 1600 "
Total		2250 "

In addition to the foregoing, man needs about 6 pounds of water, 325 grains of salt, and 170 grains of phosphates, potash, salts, etc.

TABLE SHOWING THE CALORIC VALUE OF CERTAIN FOODS.

Food.	Calories per Pound.
Bacon	3080
Beans	1615
Beef	1460
Butter	3615
Corn-meal	1645
Cheese	1620
Chocolate	2650
Crackers	1920
Flour	1644
Ham	1950
Milk, condensed	1595
Milk, fresh	418
Oatmeal	1850
Peas	1565
Potatoes, raw	375
Rice	1630
Sugar	1820
Salt pork, fat	3510
Sausage	2065
Tapioca or cornstarch	1820

The value of knowing the caloric value of food is of the utmost importance in practical dietetics. Supposing we wish to consistently try a *milk diet*. While milk contains all the food elements necessary to maintain the nutritive equilibrium, a quantity of 3 to 4 liters (2500 calories) is necessary daily. Now, such a quantity of milk would burden digestion, but this may be obviated by using cream, one of the most easily digested fats. A pint of cream will yield 1125 more calories than four quarts of milk. Thus the ingestion of milk with sterile cream in the proportion of 1 to 4 enables one to reduce the milk from 1½ to 1¾ liters daily and still maintain sufficient nutrition for a patient confined in bed. Peptonized milk may be prepared with only a trace of bitterness as follows: A gill of water is added to one pint of skimmed milk. This is heated to 140° F., and then 3 grains of powdered pancreatin and 15 grains of carbonate of sodium are added and thoroughly mixed. Allow the mixture to remain warm (near a stove) after covering for about an hour and a half, when it is ready for use after cooling.

The so-called "meal" consists essentially of laying in a store of provisions for future emergencies: not so much for the object of satisfying the necessity, as for providing for the necessities which may arise. Nature has made provision for the camel's endurance of long drought with great masses of cells in which water is stored up, and had she considered that this provision was necessary for man, she would have created it. The average meal is practically the cameloid method of storage. Eating frequently during the day and proscribing "meals" will do much to obviate the tendency of overeating. If one will not eschew the conventional meal, rising from the latter at a time when hunger is appeased, or when still feeling "a little hungry," will accomplish the same object.

Weight.—The ratio of weight to height is of value only when such ratio is out of all proportion (in excess of 15 per cent.). Changes in weight when compared with former weight are of diagnostic and prognostic importance. Thus the weight progressively diminishes in the following affections:

Addison's disease,
Carcinoma,
Diabetes,
Diarrhea,
Esophagus, stricture of,
Fever,
Hysterical anorexia,
Marasmus,
Pylorus, obstruction of,
Suppurations,
Thoracic duct, obstruction of,
Tuberculosis,
Ulcer of stomach.

The weight progressively increases in:

Adiposis dolorosa,
Alcoholism,
Cretinism,
Dementia,
Disseminated sclerosis,
Pseudohypertrophic paralysis,
Rachitis.

A false progressive weight increase is noted in anasarca, ascites, and in large tumors. A sustained weight with only slight fluctuations indicates that nutrition is maintained. Besides weighing for the detection of slight accumulations of fluid, the limbs and abdomen must be measured regularly. Diabetes is infrequent among underweights and cardiac disease is more common in overweights. Tuberculosis is ordinarily ruled out by overweight. Bright's disease is more common in overweights. Pneumonia, according to Symonds, is almost twice as fatal among underweights as among overweights. The same author observes that no overweight dies of old age.

The following table has been compiled by Dr. Heinrich Stern, of New York:

TABLE DENOTING MEAN HEIGHT AND WEIGHT OF BOTH SEXES IN THE DIFFERENT AGES OF LIFE IN THE UNITED STATES.

Age.	Men.				Women.			
	Body, inches.	Height, cm.	Body, pounds.	Weight, kilo.	Body, inches.	Height, cm.	Body, pounds.	Weight. kilo.
1..	28.74	73	21.78	9.9	28.50	72.4	20.24	9.2
2..	32.67	83	28.16	12.8	32.44	82.4	24.60	11.2
3..	35.82	91	32.70	14.9	35.59	90.4	29.04	13.2
4..	38.18	97	36.68	16.9	37.95	96.4	33	15
5..	40.55	103	39.60	18.0	40.31	102.4	35.20	16
6..	42.91	109	43.34	19.7	42.68	108.4	38.50	17.5
7..	45.27	115	47.08	21.4	45.04	114.4	41.58	18.9
8..	47.63	121	51.7	23.5	47.40	120.4	40.92	18.6
9..	50	127	55.60	25.3	49.76	126.4	49.06	22.3
10..	52.36	133	60.94	27.7	52.13	132.4	54.56	24.8
11..	54.33	138	66.40	30.2	54.09	137.4	58.52	26.6
12..	56.30	143	72.60	33	56.06	142.4	67.98	30.9
13..	58.27	148	78.10	35.5	58.03	147.4	77.44	35.2
14..	59.84	152	84.40	38.4	59.60	151.4	87.34	39.7
15..	61.42	156	105.80	48.1	59.84	152	97.02	44.1
16..	63.39	161	120.10	54.6	60	152.4	97.46	44.3
17..	65.35	166	132.80	60.4	60.39	153.4	..	..
18..	66.93	170	136.40	62	61.18	155.4	..	..
19..	67.32	171	138.60	63	61.84	157	118.80	54
20..	67.72	172	144.10	65.5	62.36	158.4	122.10	55.5
25..	68.90	175	151.80	69	63.15	160.4	124.30	56.5
30..	69.29	176	154	70	63.78	162	124.30	56.5
35..	68.90	175	157.30	71.5	63.54	161.4	127.60	58.
40..	68.90	175	166.60	73	63.39	161	133.10	60.5
45..	68.11	173	161.70	73.5	62.99	160	132	60
50..	67.72	172	156.20	71	61.81	157	128.70	58.5
55..	67.32	171	151.80	69	61.42	156	126.50	57.5
60..	66.93	170	149.60	68	61.02	155	126.50	57.5
70..	66.14	168	145.20	66	60.23	153	117.70	53.5

When weight is determined as a guide to nutrition, weighing at a definite time in the same clothes and under the same conditions is of great importance. The weight fluctuates according to trifling conditions. Thus, a heavy meal suffices to increase the weight fully two pounds, whereas purgation, diuresis, or diaphoresis will temporarily decrease it. The weight of the clothes in men is about $\frac{1}{18}$, and in woman about $\frac{1}{24}$ of the total weight.

The systematic weighing of infants is an excellent guide to the state of the nutrition. The following table of Gerhardt shows the physiologic increase in grams (convert grams into drams by dividing the number of grams by 3.9; and to convert grams into grains, divide the number of grams by 0.065):

Daily	increase	in	1st	month	25 gm.
"	"	"	2d	"	23 "
"	"	"	3d	"	22 "
"	"	"	4th	"	20 "
"	"	"	5th	"	18 "
"	"	"	6th	"	17 "
"	"	"	7th	"	15 "
"	"	"	8th	"	13 "
"	"	"	9th	"	12 "
"	"	"	10th	"	10 "
"	"	"	11th	"	8 "
"	"	"	12th	"	6 "

According to Hirst, the weight at birth is about 7⅓ pounds. There is a steady increase of about 1½ pounds each month before, and 1 pound after, the fourth month.

MONTH.	WEIGHT, POUNDS	MONTH.	WEIGHT, POUNDS.
1	7.75	7	16
2	9.5	8	17
3	11	9	18
4	12.5	10	19
5	14	11	20
6	15	12	21

There is normally a loss of 5½ ounces, on the average, during the first two to five days, which is usually made up by the end of the first week.

According to Widal, the occurrence of dropsy in nephritis may be detected by weighing the patient daily before it can be detected by the eye, a rapid increase in the body-weight being dependent on the retention of water (*vide* Diet in Nephritis).

The average busy physician determines the sufficiency of food necessary for his patient by determining the amount necessary to maintain the normal body-weight. The diet is excessive if the latter is exceeded, and insufficient if the latter is not maintained. During the active growth of the individual it is often difficult to estimate what constitutes the normal body-weight, but in the adult the latter may be defined as the minimum weight consistent with the health of the individual.

2. **What to Eat.**—The fruitarian or vegetarian emphasizes his particular fad by directing attention to the necessity of subsisting on a special kind of food. The poet Shelley was a dietetic revolutionist, and with the same method of reasoning wanted us to become vegetarians and marry our sisters. Man is essentially an omnivorous animal, and he is therefore justified in making his selection from all the nutritious products furnished by nature; therefore a mixed diet responds best to our demands. Virchow thus expresses himself: "History shows us that the highest attainments of the human race have emanated from nations who have lived and live on mixed diet." Our dietetic sins can never be solved by faddists. Vegetable foods contain a large quantity of water and a small amount of proteid and fat, hence they must be consumed in excessive quantity to furnish the proteid that is required. The albumin of vegetables is less easily absorbed than animal albumin, hence this fact demonstrates the still greater quantity of vegetable food that must be ingested to meet the demands of nutrition. Thus 2000 grams of dry lentils, which contain a large quantity of proteid for a vegetable food, contain only as much proteid as would be furnished by 600 grams of cooked meat. The kind and amount of food vary according to different modes of life. Physical requires more food than brain work. Aged persons require less food than the young, for the reason that the tissues have ceased to grow, and repair proceeds slowly, and their food should be consumed at frequent intervals, rather than at one time.

Metabolism.—Nutrition may suffer from the withdrawal of certain food-stuffs. In hunger fat is mostly consumed, and albumin to a less extent. Fat limits the consumption of albumin; hence the more fat, in instances of starvation, the longer hunger can be protracted. It has been estimated that during starvation five-sixths of the heat is furnished by fat and one-sixth by albumin. There is diminished excretion of water and salt, and the latter finally ceases entirely. By depriving the body of certain food elements a condition of partial hunger is created. Partial hunger arises from the withdrawal of salts, water, albumin, carbohydrates, etc.

3. **How to Eat (Euphagia).**—The primary requisite is a clean mouth and good teeth. The mouth should be rinsed and the teeth cleaned before and after each meal, so that taste, which is so necessary to good digestion, may be made more acute. The occasional use of a tongue scraper is indispensable. The most important act in eating is *mastication.* The latter achieves the following: it facilitates the swallowing of food; it breaks up the food so that it can be acted upon by all the digestive fluids; it increases the flow of saliva. The majority of cases of indigestion may be traced to imperfect mastication. Prolonged mastication increases the nutritive food value, and in consequence less food is demanded to meet the body requirements. Fletcher found that after he had begun to insalivate his food excessively, both liquid and solid, until all its original taste had been removed, there was a curious inability to swallow and a closing of the throat against imperfectly masticated food. All liquids, like soup, coffee, tea, etc., must be regarded in the same way as solids, and thoroughly insalivated before being swallowed. It is a good rule never to put into the mouth anything which resists a moderate use of the knife and fork, and never to swallow anything which one cannot bite.

It was formerly supposed that the quantity of food stimulated the alimentary reflexes, but now we know that the latter are not mechanic, but chemic. Free acid in the stomach opens the pylorus, and the acid contents now coming in contact with the duodenum provoke a reflex which closes the pylorus. The bile and pancreatic juice neutralize the acid, and a fresh outflow of gastric contents occurs. Thus the foregoing automatism is chemic and not mechanic. Mastication also increases the flow of gastric juice and exalts the sense of taste. Pawlow has shown that when a dog swallows small pebbles (salt, balls of starch, etc.), the glands of the stomach do not secrete, whereas when meat or sugar is ingested, there is an immediate flow of juice. In other words, the intensity of the secretion is proportional to the pleasure provoked by the food. Some one suggested that to counteract dyspepsia one must count the bites. For every mouthful of meat, thirty-two bites, or one for every tooth. If the meat is tough, sixty-four bites must be allowed, and ninety-six bites if very tough. Thorough mastication prevents overeating. The modern tendency of eating is to reject food requiring mastication, and this refers in all cogency to soft and pappy foods which can be swallowed in large quantities. Drinking during meals is an excuse for lazy mastication. To encourage the exalted art of mastication, meat should be cut into very small pieces before being introduced into the mouth. Many of our foodstuffs regarded as indigestible are only so because they have been incompletely comminuted by chewing. The epoch-making experiments of Pawlow show the psychic influence on digestion, and show that attention is necessary for digestion and the enjoyment of food. Eating is a function too important to be treated in a desultory manner. We should dine, not eat. Pleasurable anticipations put into action the functions necessary for good digestion. When the entire dietetic question is sifted to its rational status, one is not very far astray in saying, it is not what one eats, but how one eats. If one eats in a hurry (tachyphagia), or when tired, and immediately resumes work before digestion is fairly started, all the diets and predigested and breakfast foods will not save one from dyspepsia and its attendant evils.

4. **When to Eat.**—The essential factor in digestion is appetite. "Let good digestion wait on appetite, and health on both." It indicates the necessity of the body for nourishment. Pawlow, in his book, "The Work of the Digestive Glands," shows the digestive value of appetite. Into the stomach of a sleeping dog, or one whose attention was diverted, 100 grams of flesh were introduced through a fistula. The withdrawn flesh, after a lapse of an hour and a half, showed that the meat loss in weight was only six grams. The like amount of flesh was again introduced into the stomach of the dog through the gastric fistula, but in this experiment the food was not introduced until the appetite of the animal had been stimulated by the sight and smell of the meat. Under such conditions the weight of the flesh was reduced 30 grams after the same lapse of time. The following "golden rule" in dietetics is formulated by Pawlow: "Give no directions with regard to food until you have made inquiries concerning the inclinations and habits of your patient."

Eating when exhausted is a deplorable habit, yet the most copious meal of the day is eaten when the body is exhausted after the labor of the day. "A tired stomach is a weak stomach." If food is really needed when exhausted, only a small and easily digested quantity should be ingested. Sufficient time must always be allowed for a meal. Thus, in railroad travel or when in a hurry, it is always advisable to omit the meal and satisfy hunger temporarily by some liquid nourishment. Never eat when tired is equivalent to the simple and effectual direction of Sir Andrew Clark to a busy man who barely got through his day's work in time for the evening meal, "Dress for dinner."

FOOD POISONING (BROMATOXISM).

"Death in the pot" is of varied origin. Food is most frequently poisoned from accidental contamination. Thus, grains used as food may become infested with fungi and cause ergotism, or food may be contaminated by putrefactive bacteria. It is customary to speak of food-poisoning as "*ptomain poisoning.*" The latter term, however, must be restricted to include toxic substances (ptomains) elaborated outside the body by the action of bacteria, and such intoxication usually follows the ingestion of decomposed food. We must not forget that the poisonous mushroom and certain fish physiologically elaborate their own toxic products independent of putrefaction.

Meat Poisoning (Kreotoxism).—From decomposed sausages (botulism), head-cheese, pork pie, ham; occasionally from beef and veal, and rarely from mutton and lamb. Epidemics from meat poisoning are not infrequent, insomuch as the decomposition of the food-products is not always evident to taste. The symptoms may be preceded by a period of incubation lasting two days, during which time the following are present: languor, anorexia, nausea, abdominal pains, chills, tremors, dyspnea, sweating, giddiness, thirst, dysphagia, headache, muscular weakness, etc. In the majority of patients the symptoms are immediate and violent, and consist of acute gastro-intestinal irritation and offensive stools. Canned meats have also contributed to meat poisoning. It is stated that certain game birds, especially the grouse, are poisonous at certain seasons in definite districts.

Milk Products.—Milk may be bacterially contaminated when it is obtained from diseased animals through whose mammary glands pathogenic organisms pass. Later it may be polluted in unclean dairies by other organisms. Milk products, such as ice-cream, custard, and cheese, if poisonous, may yield toxic symptoms not unlike those developed in meat poisoning. Tyrotoxicon, formerly regarded as the chief poison of such intoxications, is now regarded by Vaughan as secondary, insomuch as other more active poisonous albumins are present.

Shellfish and Fish Poisoning.—Here the symptoms correspond to meat poisoning. Oysters, if decomposed, may be poisonous. From mussels a ptomain (mytilotoxin) has been obtained from the liver. It has been demonstrated that the edible mussel from the open sea becomes poisonous in filthy water. Fish poisoning (ichthytoxismus) is the resultant of two factors: either from poisons physiologically developed in certain glands of the fish, or as a product of bacterial growth due to the ingestion of putrefied fish, especially mackerel, haddock, and cod. The salted sturgeon in Russia has caused many instances of fatal poisoning. *Beri-beri* (an epidemic polyneuritis) is attributed by some to fish poisoning. Others refer its origin to exclusive rice nourishment, or at least to rice which, for some unaccountable reason, has become toxic.

Grain and Vegetable Food Poisoning.—Ergotism is caused by the ingestion of meal made from grains containing the ergot fungus (*Claviceps purpurea*). Degeneration of the posterior columns of the spinal cord, resulting in a clinical picture resembling locomotor ataxia, has occurred in chronic ergotism. Lathyrism, a form of spastic paraplegia, is caused by the use of meal from varieties of vetches. The grain is commonly known as the chicken-pea. Lathyrism has been observed in India, Italy, and Algiers. Pellagra (Italian leprosy) is a disease caused by the use of fermented or diseased maize, and is peculiar to Italy, Spain, and the south of France. It is manifested by an erythema which appears in spring, followed by desiccation and exfoliation of the epidermis, digestive troubles, cachexia, mental symptoms, and finally paraplegia.

Potato Poisoning.—Potatoes contain normally a small percentage (0.06) of solanin. When this poisonous substance is increased in amount, as happens in potatoes exposed above ground during their growth and in those which have become well sprouted during storage, their consumption may lead to dangerous but rarely fatal symptoms of gastro-intestinal poisoning.

Mushroom Poisoning.—Harmless varieties may cause poisoning in susceptible individuals. The most toxic variety, *Agaricus muscarius*, contains muscarin as the active principle. This fungus is bright red, with yellow spots. Poisonous fungi grow in dark places, are highly colored, and have an astringent taste and a pungent odor. The symptoms are gastro-intestinal, with early heart failure.

Individual susceptibility is an important factor in many forms of food poisoning, and "what is meat to one is poison to another." Oysters, crabs, lobsters, and other shellfish, pork, sausage, seasoned meats, strawberries, tomatoes, etc., may cause urticaria in susceptible persons.

DISEASES CAUSED BY FOOD.

Some one has appositely said, if he knew what would cause consumption, he could cure it. Acquired immunity to the disease is a question of environment, climate, air, sunshine, habits, food, etc. Knowing what will produce consumption, we can cure it in an allopathic direction by introducing the patient to conditions incompatible with his disease. So it is with food in the etiology of disease. The latter question is not sufficiently emphasized in our textbooks, but, under the heading treatment, the food applicable in certain diseases is described in detail. Take the antitheses of such food, and one finds a reliable guide for food in the causation of disease.

ANIMAL PARASITES.

Amebic Dysentery.—Contaminated drinking-water and green vegetables especially lettuce. Musgrave has developed amebæ from ice-cream.

Cestodes.—*Tænia solium*, or pork tapeworm, inhabits the intermuscular connective tissue of the hog, and infection occurs from eating raw or insufficiently cooked pork. *Tænia mediocanellata*, or *saginata*, is found in the muscles and viscera of cattle, and perhaps in goats and sheep. Infection occurs from eating raw or insufficiently cooked beef. The *Bothriocephalus latus* is confined to districts bordering on the Baltic Sea, in Switzerland and Japan.

The larvæ develop in the peritoneum and muscles of the pike and other fish, which, when ingested, grow into the adult worm.

Echinococcus Disease.—It is estimated that in Iceland every seventh person harbors the parasite. The disease, however, exists everywhere. The common hosts of the parasite are dog, fox, wolf, and sheep. It is supposed that the intimate relationship existing between people and dogs favors infection, which is conveyed from the tongue of the dog to the lips of his master. It is probable, however, that contaminated drinking-water and infected vegetables and meat are more frequent sources of infection. Scolex-bearing cysts have been discovered in the liver and tissues of the ox, sheep, goat, deer, horse, hog, and other animals. The frequent occurrence of the disease among the shepherds of south Australia has been attributed by Richardson to the ingestion of mutton, the sheep having become infected from the shepherd dogs.

Distomiasis.—Flukes cause many diseases. There is the pulmonary form of distomiasis (parasitic hemoptysis), a disease characterized by a chronic cough, rusty-brown sputum, and hemoptysis of varying grades of severity. The parasites may involve other organs, notably the liver and brain. It has been estimated that 15 per cent. of the entire population of China, Korea, Formosa, and Japan is infected. Many cases have been reported in the United States, and the hogs of the infected districts have been the hosts of the parasites. In *hepatic distomiasis* we are likewise dealing with an affection commonly found in oriental countries, although eighteen cases were found in San Francisco by White. The disease may be endemic, and the chief symptoms are intermittent diarrhea and jaundice, fever, enlargement of the liver, and, after several years, the patient is reduced by anasarca and anemia. The affection is very prone to recurrence. The ova of the parasites are easily detected in the stools. The common liver fluke is a parasite common to the ruminants. *Bilharziosis*, caused by the blood fluke, is a common disease in lower Egypt, where it is encountered in one-third of the autopsies. The symptoms are usually confined to the genito-urinary tract, and consist of bladder irritability and hematuria. The ova are found in the bloody urine or in the blood or mucus from the rectum. The parasite (Bilharzia hæmatobia) is ingested with water or infected food.

Malaria.—Laveran, in 1880, discovered the parasites in the blood of malarial patients. Next Manson and Ross demonstrated that the parasite developed in the bodies of the mosquitoes, and that the malarial parasites of human beings develop only in the mosquitoes of the genus *anopheles.* Later, Italian observers demonstrated the direct infection to man by the bite of the infected mosquito, and, later still, Koch showed that it is possible to eliminate malaria in a given district by eliminating mosquitoes, protecting man from their bites, and preventing infection of mosquitoes by isolation of patients affected with the disease.

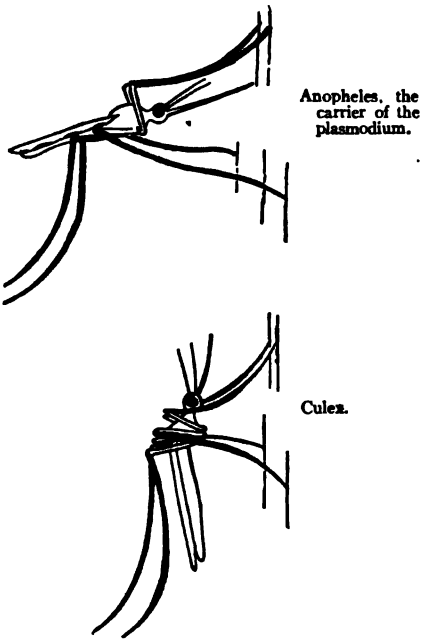

Fig. 2.—Resting attitudes of culex and anopheles.

All species of the anopheles may be hosts of the malarial parasite; the ordinary mosquito (*culex*), however, is not capable of infecting. The attitude of the two varieties resting on a wall is suggested as a means of differentiation. The culex, when sitting on a wall or ceiling, holds its posterior legs turned upon his back, whereas the body lies nearly parallel to the wall. The anopheles, however, holds its posterior pair of legs either against the wall or hanging downward. The body protrudes from the wall or ceiling at an angle of about 45 degrees, instead of lying parallel. The culex is a city, and the anopheles a country, insect.

While it is assumed that the bite of the anopheles mosquito is the accepted mode of infection in man, we cannot deny the possibility of infection through water or vegetables grown in a malarial region, insomuch as the anopheles lays its eggs in shallow puddles or slowly running streams.

Nematodes.—In ascaridiasis, caused by the *ascaris lumbricoides*, chiefly encountered in children, we are dealing with a parasite which is exceedingly migratory in character. It has been known to creep into the larynx and produce death by asphyxia; it may crawl into the Eustachian tube, and large numbers have been found in the bile-ducts. A pyrexia of some duration (typho-lumbricosis) and nervous symptoms suggestive of meningitis have been attributed to the parasites, which produce such symptoms either reflexly or by virtue of a toxic agent developed by the ascarides. The same species of this parasite has been found in the pig and sheep. Infection occurs through drinking-water or from contaminated vegetables washed with such water. The *oxyuris vermicularis*, also known as the thread-worm or pin-worm, is a parasite commonly found in the rectum and colon of children, and, like the ascaris, is given to migration. It has been known to pass through the intestinal wall, and has been found in the fossa of Douglas (verminous tubercles) or in perirectal abscesses. The source of infection corresponds to the ascaris, although self-infection and transference to others may be effected by the fingers, which are used to allay the itching of the parts caused by the migratory antics of the parasites from the rectum. Perhaps the eggs of the oxyuris as well as other parasites may be distributed by flies.

Trichiniasis.—This is caused by the trichina spiralis, and is a disease more commonly recognized at the autopsy than at the bedside. Its frequency is shown by the investigations of Williams, who studied the muscles from five hundred and five unselected autopsies and found the disease present in twenty-seven cases, although all the subjects died from diseases other than trichiniasis. Occurring in epidemics, there is little danger of failing to recognize the disease, but the sporadic cases are generally overlooked. The invariable source of infection is from the consumption of flesh of trichinous hogs. In Germany, where a careful microscopic examination of all swine flesh is made before it is sold for food, about one hog in 1852 is trichinous. In America, where inspections are not obligatory, as in Germany, the percentage of infected animals is about 1½. Infection is most often caused by eating the raw products (ham and sausage), which is a common practice in Germany. Thorough boiling of the meat absolutely destroys the parasites.

If, however, boiling is insufficient, so that the high temperature fails to reach the central portions of the flesh, the parasites escape destruction. Sufficiency of cooking is determined by the uniform gray color of a cut surface and the absence of red juice under pressure of the knife. Smoking, salting, and pickling are insufficient, and frequently give rise to infection.

Ankylostomiasis, or uncinariasis, is caused by the hookworm, and is endemic in many districts, notably in tropical and subtropical countries, especially among miners. The anemia of the southern States is caused by deliberately eating the soil by the earth-feeders (*geophagi*). The embryo worm may enter the skin and be thus carried by the veins to the heart and lungs, and from there to various parts of the body. The usual source of infection, however, is the drinking-water, and contamination with the soil derived from mines and tunnels. For diagnosis, *vide* Thymol.

Filariasis.—The most important of the filaria is that of Bancroft, which causes hematochyluria and lymph-scrotum. The female of this filaria produces embryos ($\frac{1}{19}$ of an inch in length and the diameter of a red blood-cell) which reach the blood-vessels through the lymphatics. In the daytime they are usually absent in the blood, and reappear at night, but this periodicity of appearance is reversed if the patient sleeps during the day instead of the night. The parasite is common to tropical and subtropical countries, and many cases have been observed in the southern States. The bite of the mosquito is probably the chief source of direct infection. The diagnosis of filariasis is usually made when the parasites occlude large lymphatics and produce lymph-stasis, with subsequent dilatation of the lymphatics. To detect the parasites, a thick film of blood is made from blood drawn at 8 or 9 P. M., and the specimen stained with fuchsin, fixing being unnecessary. Prevention of infection is best attained by protection of drinking-water from contamination by mosquitoes and by destruction of the latter.

Dracontiasis, or **guinea-worm disease,** is peculiar to the East Indies, although cases have been seen in the United States. The adult female is observed in 85 per cent. of the cases in the legs and feet, and pierces the derma, over which point in the epidermis a blister is formed, which on rupturing shows a small ulcer, in the center of which is a minute opening. If cold water is thrown over the latter, a milky fluid exudes which contains many embryos. The worm gains its cutaneous position not by penetration of the skin, but through the stomach. Infection occurs from drinking-water obtained from surface pools.

The *trichocephalus dispar*, or whip-worm, is one of the commonest parasites of man. Thus, in Dublin 89 per cent., and in Paris 50 per cent., of all autopsies demonstrated their presence. Infection arises from drinking-water. The *strongyloides intestinalis* causes the endemic diarrhea of hot countries. The common *house-fly* must also be mentioned as a source of indirect infection. It may primarily invade the feces, and later the food. Many cases of typhoid occurring in the camps during the Spanish-American War were attributed to this mode of infection. The tsetse-fly is supposed to convey the disease known as *trypanosomiasis*, which is characterized by general lassitude, fever, wasting, and a continuous lethargy; hence the name, "sleeping sickness." The active factor in the disease is the *Trypanosoma Gambiense.* Trypanosomes are found in horses and cattle, and human trypanosomiasis is common among the natives in Uganda (twenty-three out of eighty apparently healthy natives). Europeans are rarely attacked, and the disease is uniformly fatal. Weber refers to the *psocidæ*, common in country places, which hide in hay and grain, come into contact with animals, and then frequent the houses, where they contaminate food and clothing, thus proving a medium for conveying diseases from animals to man. These insects are known to feed on fodder left by cattle after having been saturated with the saliva of the latter. The insects migrate to the houses in cold weather, and Weber[17] has demonstrated tubercle bacilli in one insect of this class. Some years ago I recall reading the report from a high authority, of syphilis having been communicated by a flea-bite.

SPECIFIC INFECTIOUS DISEASES.

Actinomycosis, caused by the ray-fungus (streptothrix actinomyces), is a widespread disease among cattle, and occasionally in the pig. According to the situation of the fungus, we have digestive, pulmonary, cutaneous, and cerebral types of the disease. The digestive type is the most common. The usual clinical manifestation of the latter type is a swelling on one side of the face or a chronic enlargement of the jaw which may simulate a tumor. The pus of the swelling contains yellowish or opaque granules, which are composed of cocci and radiating threads with bulbous ends. The germ has been known to invade the appendix and produce an actinomycotic appendicitis. The disease pursues a course not unlike that of pyemia, and while it is most often a local affection, metastases may occur. Infection in man and animals has been traced to the ingestion of rye, oats, and barley which have been contaminated by the germ. The diagnosis is made by finding the grayish or yellowish granules, which are visible to the naked eye (less than 1 mm. in diameter), and by crushing them between a slide and cover-glass and observing them with a low power under the microscope. In pulmonary actinomycosis the organism is found in the sputa.

The granules of actinomyces may be distinguished macroscopically by breaking them between two object-glasses. Thus seen, they show a dull peripheral zone (pus-corpuscles) and a transparent center. Pus or necrotic tissue by the same treatment shows a uniform opaque layer.

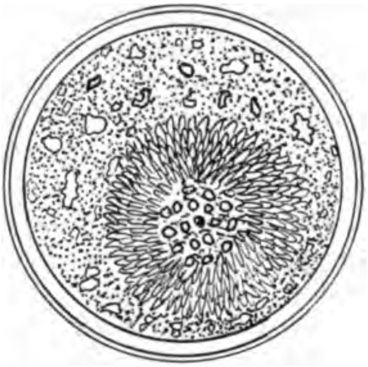
Fig. 3.—Actinomyces.

Anthrax.—This acute infectious disease, caused by the *bacillus anthracis*, is common in animals, notably cattle and sheep. In man it is sporadic and the result of accidental inoculation, to which men whose occupations bring them in contact with animals (stablemen and shepherds) or their products (butchers and tanners) are especially liable. According to the avenue of infection, we differentiate external anthrax from skin inoculation resulting in lesions known as malignant anthrax, edema, and malignant pustule. In the internal form, which may be: (1) intestinal (mycosis intestinalis)—the infectious material is conveyed by the flesh or milk from affected animals; and (2) pulmonary, from inhalation of infectious material, and occurs in those who sort or clean wool and hair (wool-sorter's disease) and in the rag-picker's disease.

Beri-beri.—This disease, essentially a multiple neuritis, is either endemic or epidemic in character, and is peculiar to the Orient. Aside from the sensory and motor symptoms of neuritis, the following are present: local edema or general anasarca, tachycardia, and signs of acute heart failure. One theory supposes that it is an acute infection due to an undiscovered germ, and the other that it is a food toxemia. The Japanese favor the latter theory, and ascribe the disease to contaminated rice and fish. Since the use of Takagi, a nitrogenous food, and the interdiction of fresh fish, the disease has practically disappeared in the Japanese navy.

Cholera.—The comma bacillus infects chiefly by means of drinking-water and contaminated food. Experimentally and clinically it has been shown that the bacilli grow rapidly in the intestinal alkaline secretions, and that the normal gastric juice will destroy them. If, however, such gastric secretion is rendered less acid by conditions which depress health, infection *per os* may occur.

Diphtheria.—The relation that polluted water-supply and imperfect drainage bear to the disease has not been determined definitely. Endemics attributed to milk have been traced to two possible causes: contamination of the milk by employees suffering from or having suffered from the disease, or from diseases of the cow's udders. In the latter instance the disease transmitted is probably streptococcus or staphylococcus diphtheriæ. There is no doubt that employees who handle other food-products may contaminate them, for it is a fact that the germs of diphtheria persist for months in the throat after recovery from the disease.

Dysentery (Bacillary).—The organism has not been found outside the human body, hence we can only surmise that infection occurs through drinking-water.

Febricula.—Febrile paroxysms of short duration, without distinctive features (lasting not more than four days), are known as febricula; and lasting twenty-four hours, as ephemeral fevers. Noted often in children associated with gastro-intestinal disturbances, they are usually provoked by indigestion.

Foot and Mouth Disease.—This very serious infectious disease affects domestic animals, notably cattle, sheep, and pigs. It is called aphthous fever, because the lesions associated with the pyrexia are located chiefly in the mouth as vesicles which break down and become ulcers. Local manifestations are not uncommon on the udder and teats of cows whose milk is yellowish-white in color and mucoid in consistency. Many fatal cases have been reported, due to the transmission of the disease to children by means of milk and other food-products. The only real safety against infection when the disease is epidemic among cattle is to use only boiled milk.

Jaundice (Infectious).—Known as Weil's disease. It is a febrile affection associated with jaundice, gastro-intestinal symptoms, muscular, articular, and epigastric pains, and enlargement of the liver and spleen. Ninety per cent. of those affected are men at about the third decade, and the disease occurs chiefly in the warm months. Butchers, sewer and drain workers are especially prone to infection. The symptoms suggest ptomain poisoning, insomuch as the disease sets in abruptly after the ingestion of tainted food or exposure to sewer gas, sewage, etc.

Leprosy.—Among the modes of infection, by inoculation, contagion, and heredity, there appears to be no unanimity of opinion. The *bacillus lepræ* has been isolated from the milk of patients. The matter of food as a source of contagion is questionable, although so competent an authority as Jonathan Hutchinson attributes the disease to the eating of spoiled fish or vegetables.

Malta Fever.—This is probably a water-borne disease, due to the micrococcus melitensis. The disease is characterized by pyrexial waves lasting from one to three weeks, with an apyrexial interval of two or more days' duration. Other symptoms are: Neuralgias, progressive anemia, and debility. The affection may be confounded with malaria, but it is uninfluenced by quinin. The agglutinative serum reaction is pathognomonic.

Milk-sickness.—Although rare, it still exists in certain parts of North Carolina. It affects sheep and horses, and in cattle is known as the *trembles*, because the muscles of the affected animal tremble. Cows giving milk may not show symptoms unless driven rapidly, and infectiousness of the milk has been shown when the disease was latent in the cow. Infection in man occurs from drinking milk or eating flesh of affected animals, and is characterized by symptoms suggesting acute infection of a typhoid character. The extremely foul odor of the breath is said to be characteristic.

Psittacosis.—This disease, occurring in birds, particularly parrots, is characterized by anorexia, diarrhea, and falling of feathers. Transmitted to man directly or through the medium of infected food, the disease assumes the nature of a severe typhoid with diarrhea and a malignant atypic pneumonia. The duration of the disease is about one month, and the mortality about 37 per cent. House epidemics of severe pneumonia from caged parrots have been observed.

Tuberculosis.—Since the famous pronunciamento of Koch that infection through food-products was rare, this question has been vigorously discussed. Koch's contention favoring his theory was that if infection were the result of food ingestion, primary intestinal tuberculosis, which is rare, would be more frequent. Von Behring, on the contrary, maintains that the milk given to infants is the chief cause of tuberculosis. Macfadyen and MacConkey found virulent tubercle bacilli in the mesenteric glands in 25 per cent. of children examined at the necropsy in whom no lesions were found elsewhere. Meat is rarely concerned in infection, thorough cooking evidently destroying the germs. There is no doubt, despite controversy, that successful implantations of tuberculosis have been made with milk of cows in which no ocular evidence of tuberculosis in the udder was demonstrated.

Typhoid Fever.—Imperfect sewage and a tainted water-supply are the chief causes of infection. Contaminated food plays a secondary rôle. The biology of the *bacillus typhosus* shows that it may retain its vitality in sterile water for weeks, but that in the presence of other germs it readily succumbs. The germs have been found in filtered water, in ice, in milk, and in milk-products, all of which, therefore, must be taken into account in tracing the source of infection. Milk infections have been repeatedly traced to infected water used for cleaning milk-cans. Vegetables grown in soil in which infected material has been employed as a fertilizer and eaten uncooked have also caused infection. Typhoid germs have been found in oysters, and many epidemics have been traced to ingestion of the latter. Flies, by contaminating food after having feasted on infected fecal matter, are undoubted causes of infection. Food may contribute to post-typhoid elevations of temperature (spurious relapses) or to real relapses. No one knows why solid food during convalescence may slightly elevate the temperature (*febris carnis*), and it is a good practice never to permit solid food to be eaten, however ravenous the appetite of the patient, until the temperature has been normal for ten days. Some practitioners permit solid food as soon as the appetite demands it. Osler cites the case of a lad whose evening temperature for two weeks had been normal, and who, after eating several mutton chops, died as a result of perforation. At the autopsy a rent was found at the bottom of an ulcer which was in process of healing.

CONSTITUTIONAL DISEASES.

Arthritis Deformans.—Called also rheumatoid arthritis, notwithstanding the fact that it is no longer regarded as related either to rheumatism or to gout. No definite etiology has been established, although defective hygiene, improper food, malnutrition, and nerve depression act as exciting causes and favor exacerbations. Two theories exist: the nervous and the theory of chronic infection. The former is better supported by clinical than by postmortem evidence. The microbic theory has gained more supporters, despite the fact that bacteriologic proof is lacking. A previous history of gonorrhea has been noted in many instances. Hadden attributes the disease in part to too exclusive use of amylaceous and saccharine food.

Diabetes Mellitus.—Statistics show that in Europe there are from 5 to 9 cases among 100,000 inhabitants, whereas in the United States there are about 2.8 in 100,000. Hebrews are especially liable to this affection: one-fourth of Frerich's patients were of the Semitic race. The Jew evidently represents a concentration of all the factors which contribute to the etiology of the disease, viz., heredity, a neurotic temperament (worry, nervous strain), obesity, overindulgence in food and drink, and a sedentary life.

The pathology of diabetes is associated with the phenomena of sugar formation in the body, and it is equally true that the sugar-consuming power of the economy is diminished. The starchy and saccharine ingredients of food are stored up in the liver and muscles as glycogen. In health this glycogen passes into the blood (which never contains more than 0.2 per cent.) as glucose, and is burnt up for producing heat and energy. Another though less important source of glycogen is from nitrogenous food. Now, in diabetes the forces which maintain the percentage of glucose in the blood (from 0.1 to 0.2 per cent.) are disturbed, for when the amount of glucose exceeds 0.2 per cent., glycosuria ensues. Theoretically, such disturbances may be variously effected: (1) The reconversion of glycogen into glucose occurs so rapidly that the amount of the latter is too large to be oxidized. (2) The sugar and starch converted into glucose by digestion are not stored up as glycogen in the liver, but pass directly into the blood. (3) That a glycolytic ferment is incapable of destroying any excess of sugar which passes into the blood.

The foregoing factors demand a brief analysis. A healthy individual can take 100 grams of glucose on an empty stomach without causing glycosuria, but if the amount of glucose is in excess of that quoted, sugar will appear in the urine (alimentary glycosuria). A healthy person may take any amount of carbohydrates in the form of starch without ensuing glycosuria, for the reason that the carbohydrates are stored up in the liver as glycogen. If for any reason the liver fails to act as a reservoir for the excess of starch, glycosuria occurs. The failure may be attributed to changes in the liver circulation or to some defect in the liver-cells. We referred to a glycolytic ferment which aids in the oxidation of the sugar in the blood. This ferment is produced by the islands of Langerhans in the pancreas, and is deficient in functional or organic disease of the latter. No one can question the fact that pancreas disease is intimately associated with the pathology of diabetes, and lesions have been found in the pancreas in 50 per cent. of the cases coming to autopsy by Hansemann and Williamson. More recently Hoppe-Seyler has described a form of pancreatic diabetes caused by arteriosclerosis of the vessels of the pancreas.

The relation that the suprarenal gland bears to glycosuria is only supported by the fact that glycosuria follows the subcutaneous injection of suprarenal extract in animals. From the foregoing the hasty conclusion has been drawn that the suprarenal gland contains a ferment which produces sugar or inhibits its destruction.

In the so-called form of *renal diabetes* in which the excretion of sugar is supposed to be caused by renal insufficiency, the sugar content of the blood is low and the glycosuria is not modified by diet. In the so-called *phosphatic diabetes*, the symptoms of diabetes (thirst, polyuria, emaciation) may be present, but the urine is usually free from sugar. The phosphates, however, are very much increased in the urine and the patients are usually nervous and may later develop diabetes mellitus.

Diabetes occurring coincidentally in husband and wife or among several members of the same family has led to the theory of contagion, a theory which is difficult of proof when the afflicted members have all been exposed to like factors conducive to the disease.

Diabetic coma, according to Frerichs, is responsible for over one-half of all deaths in diabetes. β-oxybutyric acid is the cause of this coma. Some say that the acid is derived from the fats of the body; others, from disintegration of the tissue-albumins. There is little to be done for diabetic coma, death terminating usually within forty-eight hours, and there is no absolute guide to anticipate its approach, beyond, perhaps, the increased excretion of β-oxybutyric acid. The test for the latter is not easily executed by the physician, and the only way we can get at the matter is to make the test for *acetone*, for acetonuria is an associated phenomenon of diabetic acidosis. Jacksontaylor's[92] simple and modified test for acetone is as follows: Make a fresh solution of sodium nitroprussid by dissolving a few crystals in a test-tube of water. Add some of the latter to the urine, after which add strong ammonia and pour the latter into the test-tube so that it remains on the top of the urine and sodium nitroprussid solution. If acetone is present even in minute quantity, a purplish color ensues between the union of the ammonia and the other two fluids within three minutes, eventually pervading the whole of the ammonia solution if acetone is present in considerable amount. The appearance of an orange-red ring is of no significance. Now, the urine of the diabetic should be examined frequently, and when acetonuria is present, the patient must be put on sodium carbonate until the urine becomes alkaline, and the diet must be changed and supervised, for it has been noted that a too rigorous meat diet or digestive disturbances may precipitate coma. A purely animal diet, on account of the diminished quantity of inorganic salts, leads to a saturation of the organs with acids (acidosis) and subsequent comatose conditions. A too limited diet in diabetes is as bad as a faulty diet, and inanition may be added to the disease. The maintenance of weight and a not too acid urine are of more importance than the percentage of sugar excreted.

Emaciation.—The *panniculus adiposus*, or subcutaneous fat, is a fairly good index of nutrition. Emaciation is due to a multitude of causes: anorexia, defective assimilation, excessive combustion of assimilated food, chronic digestive diseases, carcinoma, and diabetes mellitus. Progressive emaciation is frequent in chronic diseases. Loss of weight is an early symptom of phthisis, and an increase, one of the most reliable signs of improvement. In the acute psychoses a reduced body-weight is frequent, and a return to normal weight is noted during convalescence. In hospitals for the insane the daily use of the scale is as important as the thermometer. In neurasthenia an abnormal loss in weight is an evidence of disturbed nutrition, and it is difficult to say at times whether disturbed nutrition precedes or succeeds the nervous symptoms. At any rate, the Weir Mitchell treatment, which permits such patients to increase 40 pounds or more in weight, often gives marvelous results. Cabot[18] refers to two unrecognized causes of emaciation. Patients with arteriosclerosis in 85 per cent. of the cases lost from 13 to 60 pounds, either gradually or suddenly. I doubt, however, whether the emaciated is more often encountered than the fat arteriosclerotic. He suggests aneurism as another cause, when sleep is prevented by pain, though appetite remains excellent. Insomnia, then, according to Cabot, is a cause of emaciation for reasons not definitely determined. Patients with exophthalmic goiter lose weight without apparent cause, and v. Noorden shows that such patients require from 10 to 20 per cent. more food to sustain weight than do normal individuals. I have often thought that many symptoms noted during a chronic pyrexia, and in the convalescence following, have been due to insufficient nourishment. At any rate, I have often observed that the delirium, hallucinations, headache, and dimness of vision which often suggested meningitis evanesced after a more liberal dietary was initiated. I believe it was Graves who suggested that his epitaph should read, "I fed fevers." The foregoing fact must be held in mind in the dietetic treatment of obesity and diabetes.

Gout.—Although a history of heredity may be traced in about 55 per cent. of the cases, especially in the male line, food (overeating) is an undoubted exciting cause. No disease has been more prolific of polemic in the literature than gout. The richest territory in the world for the study of gout is London, and English practitioners are largely identified in clearing up its pathogeny, which has by no means been solved. As I now write, I see before me the famous Berlinese clinician, Frerichs, telling his students, in his impressive manner, that carried conviction to the auditor: "Gentlemen, I have stood at the bedside of kings and queens and at the bedside of humble peasants, and I have not encountered the disease more often in one than in the other." Gout has been called the king of diseases and the disease of kings, but "poor man's gout" is a common affection in England, where bad hygiene, bad food, and bad liquor assist in its genesis. Now, it has been shown that many of the Irish peasantry, among whom gout is unknown, develop the disease after a London residence. The cause of the latter fact has been attributed to an excessive consumption of the heavy English ales and beers, port wine, and sherry. It is assumed that the glycogenic substances in the malts and sweet wines undergo acid fermentation in the stomach, and the absorption of the acids, by reducing the alkalinity of the blood, impairs its power of holding uric acid in solution. The uric acid theory prevails in gout. Whether this theory is right or wrong, we cannot escape the conviction that we are merely dealing with a question of supply and demand. Take a man of forty, the age of gouty manifestations: not only does he eat too much, but he abets such indiscretion by an irregular and sedentary life, well diluted with copious draughts of alcohol. No theory yet advanced in gout has been of the slightest benefit in the treatment of the affection. *Colchicum*, an empirical remedy, and almost a specific for the attacks, is still paramount.

We recall what Fothergill said of food in gout: "There is no nice way of having gout, and, what is worse, there is no pleasant way of avoiding it." The fascinating *uric-acid theory* fails to respond to experimental investigations. Uric acid is not poisonous, and is, in fact, absolutely non-irritating to the tissues. It is not the retention of uric acid in the blood which produces the so-called uric-acid diathesis, but the presence of other products, the result of deficient oxidation. If uric acid is in excess in the blood, it is equally so in leukemia and chlorosis. It is even questionable whether the alkalinity of the blood is diminished in gout, and it is more than likely that in the acute attacks of gout there is no increased quantity of uric acid in the blood. Gout cannot be produced by injecting uric acid into the blood nor by preventing its elimination through the kidneys, but you may develop symptoms in a susceptible person by a few glasses of sherry or port, and the latter is a fact worth recalling in atypic cases. Luff observes that he has met with gouty individuals past middle age in whom two or three glasses of claret or Burgundy will, in the course of a few hours, cause the development of an eczema. It is claimed that iron decreases the elimination of uric acid, and that its administration may precipitate a paroxysm of gout. It is a recognized fact that individuals with a tendency to gout suffer from attacks during periods of physical repose. *Vide* Cholelithiasis for the further study of diet in gout.

Rheumatism (Chronic).—*Vide* Cholelithiasis.

Rickets.—More than two hundred and fifty years ago Thomas Fuller said: "There is a disease of infants called the rickets, wherein the head waxeth too great while the legs and lower parts wane too little." The disease in the United States is not as common by any means as in the large cities of Europe, whereas in London and Vienna from 50 to 80 per cent. of all the children at the clinics show signs of rachitis. The essential morbid anatomy of the bones is one of hyperemia, which increases absorption and prevents deposition of lime salts. Chemically, rickety bones show a diminution in the mineral constituents (calcium salts), which may be as low as 25 per cent., whereas the organic matter may amount to 65 per cent. While rickets is favored by foul air, absence of sunlight, and exposure to dampness, its real etiology is associated with food, for it is found among wealthy children with the best hygienic environment. Condensed milk, proprietary foods, and food rich in starches and deficient in animal fat and proteids are mainly concerned in the causation of the disease. Lion cubs at the London "Zoo" developed rickets and could not be reared. Bland Sutton caused the disappearance of the disease by adding milk, pounded bones, and cod-liver oil to the meat diet.

Scurvy (Scorbutus).—This affection, characterized by debility, anemia, a spongy condition of the gums, and hemorrhages, has more recently been attributed to a micro-organism, but there is reason to believe that the chief cause is the absence from the diet of fresh animal or vegetable food, or the latter is ingested in insufficient quantity.

Macvicar,[215] who has recently investigated the etiology of this disease, concludes that food may be in perfectly good preservation and yet lack the antiscorbutic power of fresh food. Thus, men on polar expeditions using tinned vegetables and even lime-juice became scorbutic, but lost their symptoms of scurvy as soon as they had access to fresh seal meat. This affection, called "the calamity of sailors," is easily recognized when a number of individuals are affected, but there are isolated cases which one sees in private practice: one may refer to them as anemia, and their scorbutic character is unrecognized until they rapidly and favorably react to a diet consisting of fresh meats and vegetables, with the juice of lemons several times a day. Imperfect food supply in children causes infantile scurvy or Barlow's disease. The proprietary foods (malted and condensed milk) are chiefly concerned in the etiology. The main symptoms are: hemorrhagic subperiosteal extravasation, with thickening and tenderness of the bones, notably the shafts of the bones in the lower extremities; the lesions are symmetrical and the joints are not involved; active and passive motions of the extremities cause pain, and there is profound anemia. The most frequent period of the disease is from the ninth to the eighteenth month. These cases rapidly recover after the use of fresh cow's milk, meat-juice, and orange or lemon juice.

Obesity.—Lord Byron spoke of "oily dropsy" in referring to the obesity of individuals. Cheyne is responsible for the aphorism, "We eat too much after forty years of age." The curious rather than gastronomic visitor to Strasburg who is desirous of noting the preliminary stages of *pâté de foie gras*, finds that the geese are excluded from light, stuffed with balls of carbohydrate food, and given but little space for exercise. Practically the same factors plus alcohol are concerned in human obesity. When heredity, anemic states, and sexual continence are factors in obesity, then food plays a minor rôle only. After forty, we become either thin or fat. Carbohydrates (starches and sugar) among the food-products are chiefly at fault in obesity, for they oxidize so rapidly that the stored fats are not called upon for force production. Beer, which contains over 5 per cent. of carbohydrates and from 3 to 4 per cent. of alcohol, acts in a dual direction, by supplying carbohydrates, and the alcohol hastens albuminous metamorphosis, setting non-nitrogenous substances free, which are easily converted into fat and deposited. Anything which will retard the intake of a sufficiency of oxygen for oxidizing purposes will hasten fat accumulations; thus it is that obesity is frequent in those who lead a sedentary life and in anemic states, because there is not enough iron to carry sufficient oxygen. The *Oertel diet*, which diminishes the ingestion of fluids, is a kind of desiccation (Strümpell), and reduces weight more by the abstraction of water from the tissues than by a removal of fat. We must never forget that obesity may be merely a question of heredity, and to attempt to reduce such patients, who are often small eaters, is to reduce the body requirements below the standard necessary for nutrition and effect irremediable injury. Of the food-products, albumin is most easily destroyed by the cells; next come the carbohydrates (especially sugar), and finally fat; hence the latter two food-products are chiefly concerned in the accumulation of bodily fat. This subject is continued in *dietetic diagnostic therapeutics* and under *thyroids* in diagnosis.

DISEASES OF THE DIGESTIVE SYSTEM.

Appendicitis.—The appendix in the norm contains mucus. The concretions sometimes found are usually fecal and rarely foreign bodies. The physiology is unknown, although in some lower animals it is a large organ and assists digestion. The bacteriology is essentially that of the cecum, with which it is in communication. Many causes have been suggested for the disease, but the majority are unsatisfactory. My friend, Woods Hutchinson, observes that the lumen of the appendix with advancing years obliterates by atrophy, and that nearly 70 per cent. of all persons over sixty-five have permanently closed appendices and could not have an appendicitis under any circumstances. It is true that appendicitis is a disease of children and young adults; about 50 per cent. of cases occur under the age of twenty, and 30 per cent. between twenty and thirty; and nearly 80 per cent. of all cases occur in males. Many cases of acute and chronic indigestion are in reality instances of appendicitis. Ptomain poisoning is often confounded with appendicitis. Now, respecting food, all of us know how a chronic appendicitis may be lighted into activity by attacks of indigestion, and there is no question in the minds of many of us that habitual constipation, insufficient mastication, and chronic dyspepsia are potent predisposing causes of the disease. Foods yielding a bulky residue must be avoided. Foods containing seeds or dense skins, like cabbage, corn, and fruits, must likewise be interdicted, not because we anticipate their entrance into the appendix, but on account of their tendency to create intestinal indigestion. In a word, food should be simple, easy of digestion, and incapable of taxing the digestive apparatus. Attention must be paid to a thorough daily evacuation of the bowels, or, as Illoway correctly puts it: the prophylaxis of appendicitis is synonymous with the careful treatment of habitual constipation.

The influence of food on appendicitis is witnessed in the Ochsner treatment. He believes that an operation is indicated in every case of the disease, if done within the first thirty-six hours, or before the disease has progressed beyond the appendix itself; otherwise not until the attack has entirely subsided, unless a circumscribed abscess should have developed. He believes that general peritonitis is hastened by operations in advanced cases. His method of starvation is as follows: All food and cathartics by the mouth are prohibited. If nausea or vomiting is present, gastric lavage is done, and repeated if necessary. The patient is supported by nutrient enemata. Freedom from symptoms for at least four days is an indication that feeding by the mouth can be commenced, first with a few ounces of beef-tea every two hours, and on later days, predigested foods, diluted milk, etc. The rectal feeding is continued until nourishment by the mouth is sufficient. The Ochsner plan has given excellent results in acute cases, which would otherwise have died if an operation had been performed.

Cholelithiasis.—Gall-stones are due essentially to microbic invasion of the bile-passages, which excites a catarrhal inflammation and leads to the precipitation of cholesterin and salts. Calculi have been experimentally produced by injecting micro-organisms into the gall-bladder of animals. The influence of microbes is witnessed in the specific fevers, when gall-stones complicate or follow the diseases in question. Thus, the bacillus of typhoid fever has been isolated in pure cultures seven years after an attack. About 50 per cent. of the cases have been observed in persons above the age of forty. Three-fourths of the cases occur in women, and 90 per cent. of them have borne children. Corset-wearing, a sedentary life, and overfeeding, by favoring bile stagnation, predispose to the formation of calculi. Calculous formations in the body are also so closely related that what is said of gall-stones refers in all cogency to *renal calculi*, *lithemia*, etc., as well as to *gout* and *chronic articular rheumatism.*

The entire question resolves itself into this: the intake of food is in excess of nutritional demands, which the body is incapable of oxidizing or using. It is not a question of the quality, but the quantity, of food. Hence specific diets are often faulty. Moderation in food ingestion is a task less difficult of acquisition than is the exclusion of specific food-products from the dietary. Some say that fat, sugar, and starch are in no way directly concerned in uric-acid production; that, on the contrary, they restrict the ingestion of nitrogenous food and indirectly diminish such production. It seems to be the prevailing opinion that albuminoid food is best oxidized when carbohydrates are ingested in minimum quantities, and that the best diet is a modified nitrogenous one without an excess of starch or sugar. Mineral waters are of value, owing to the water which they contain, the other ingredients being of mythical value only. We still pay many tributes to mythical medicine and hug many delusions with the persistency of bigots. Some advise sea-voyages, firm in the belief that *nausea marina* will cure many supposititious maladies, when, if emesis were really desirable, the more scientific and less cumbersome way would be to give an emetic. So it is with mineral waters, the medicinal ingredients of which are so infinitesimal that in prescribing them we are unconsciously following the homeopathic doctrine of attenuation. Some attribute the efficacy of the waters to a mysterious tellurial force, and since the discovery of radium, radioactivity has been demonstrated in some mineral waters, which fact has been cited to establish their value. The baths can only act reflexly, for there is no absorption of the ingredients through the skin. Mineral springs are of unquestionable value, for the reason that they impose on the visitor methodical habits in the way of eating, resting, exercising, etc.

Constipation.—A patient once told me, in detailing his symptoms, that as far as his bowels were concerned, they were in perfect condition, as they moved regularly once a week. Our views concerning constipation have been considerably modified. In one class of patients constipation may exist without any symptoms, whereas others complain of headache, anorexia, lassitude, mental depression, etc. The latter symptoms have been dignified by the term *copremia*, which is supposed to indicate fecal poisoning. The fetich of many neurasthenics is the water-closet, and the elysium of others is a purgative. It is easier to take a simple pill than to pursue a prolix dietetic régime, hence the prestige of "the purgative habit." It is a well-known fact that the normal stimulus to intestinal peristalsis is furnished by the material in the bowels, and that an herbivorous animal will die as a result of constipation if cellulose is excluded from the dietary, cellulose being the normal excitant of peristalsis. One must not suppose that an easily digested and absorbed diet is the best. Thus animals are unable to subsist on such food, and in feeding experiments it is often necessary to add cellulose in the form of filter-paper to maintain them in good condition (Sollmann). The latest and most notable contribution to the subject is that of Schmidt.[19] He discredits the accepted view that the defect in constipation is resident in the nerves and muscles of the intestine; that, on the contrary, the food is so thoroughly digested that the little residue left is hard and dry. In consequence of this diminished débris there are fewer bacteria, and the diminished decomposition products are insufficient to irritate the intestines into activity. In accordance with this view we know that investigations have shown that the feces in constipation contain fewer bacteria than normal, they show little evidence of decomposition, are almost odorless, and neutral in reaction. Schmidt's idea, carried into practice, has given good results, the object being to increase and soften the intestinal residue. This, we know, is attempted, though ineffectually accomplished, by the addition to the diet of whole wheat bread, nuts, fruit, etc. Whereas the latter may cause a bulky residue, they fail, for the reason that they do not soften such residue, which is essential for an easy evacuation. To achieve both objects, the author uses the *agar-agar* of bacteriologists, which absorbs water and is practically indigestible. About 10 to 20 grams of this substance, finely chopped, are added to the food. Acting on the same theory Blümel recommends the successful use of sawdust bread for habitual constipation. An ounce of finely sifted beechwood sawdust is incorporated into a pound of wheat bread dough. At the risk of interfering with the continuity of my subject, I am going to refer to a method which has almost invariably succeeded when the conventional methods have failed.

Abdominal Massage for Constipation.—This is a combined psychic and mechanic method. The psychic factor takes into consideration the fact that the desire to go to stool is a habit. Habit in itself is a great economizer of nerve force, for it is automatic in action and reduces cerebral participation to a minimum. Thought directed toward a part will increase its functional activity. We know how the mental state may influence the intestinal canal, and I may cite nervous diarrhea as an example. The diarrhea of students before an examination, of nervous women and men during transient periods of excitement, etc., is of this nature. Canstatt tells of a surgeon who had an attack of diarrhea before every important operation. Patients are first informed respecting the direction of the intestines; are told that purgatives act by stimulating the intestinal musculature; that the same effect can be attained by direct pressure on the intestinal walls; that the reason why massage has failed to do them good (if they have already had it done) is because the moment the hands of the masseur come in contact with the abdominal muscles, the latter involuntarily contract, and resist the penetration of the hands to the intestines below; that they must be their own masseurs; that this massage must be practised twice daily, at first on rising in the morning and on retiring, and that each séance must last at least ten minutes; that séances may require less time, and that their repetition may become less frequent according to the results achieved; that, in short, the method is a mechanic manual purgative. After breakfast, and at no other time, they must visit the toilet.

PLATE I.

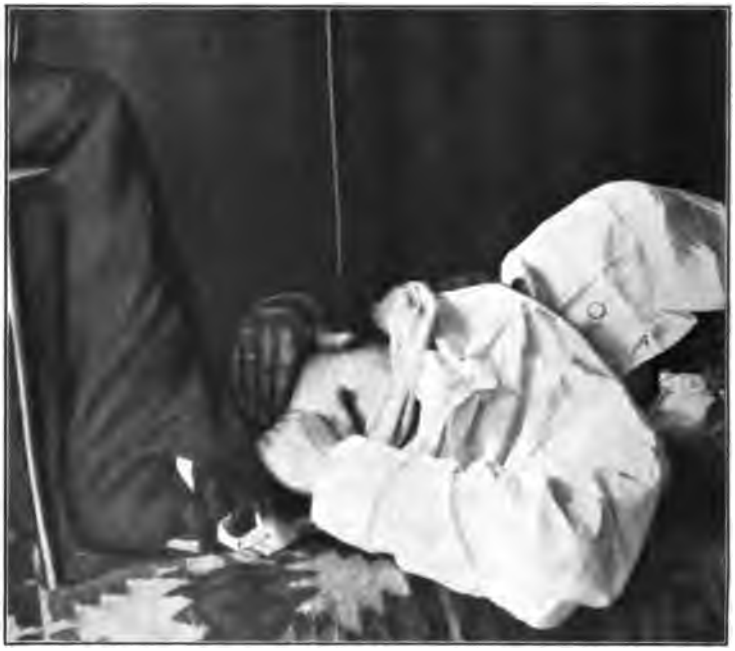

Fig. 4.—Method of executing abdominal auto-massage for constipation. The legs are thrown across a chair resting on the couch to attain thorough relaxation of the abdominal muscles. The hands of the patient are approximated at the tips of the fingers and the massage is rotary in character. Each abdominal region is thus massaged systematically in succession, and the séance must last about fifteen minutes each day.

Massage: The patient places himself in the recumbent posture on a firm background (floor preferred), with legs across a chair (*vide* Fig. 4), to secure the greatest possible relaxation of the abdominal musculature. Then, with the fingers of both hands, every part of the abdomen must be gone over, and pressure so made as though an attempt were made to squeeze out the contents of the abdomen. The pain which the patient may experience after the second or third day of the massage is temporary, purely muscular, and is no indication for discontinuance of the treatment.

This method is of undoubted value in many abdominal neuroses. Experiments show that abdominal massage improves the mobility of the stomach, and that in dyspepsia without dilatation of the organ digestion is so augmented that fluid passes the stomach in from twenty to forty-five minutes, and solid food after one and one-quarter hours. Leber and Stüve demonstrated that abdominal massage increased the consumption of oxygen (12 per cent.) and the production of carbonic acid (15 per cent.). My own investigations show that indican and the sulphates are augmented in the urine after massage, and that indican was found in the urine, even though absent before abdominal manipulations were made. If such products are brought to absorption, it is evident that intestinal digestion may likewise be influenced, and that this is so can be demonstrated by the benefit which intestinal dyspeptics derive from the manipulations. Although I have shown in recent works[20] that large quantities of blood are expressed from the abdomen by massage, the latter is without influence on the blood-pressure.

Diarrhea.—Acute dyspeptic diarrhea in adults and children is caused by improper food, by overeating, or by special articles of food, notably fruits. Fruits are such legitimate elements of our dietary that they are rarely regarded as offensive, yet when fresh fruits are eliminated from the dietary, many obscure symptoms associated with the alimentary canal, not necessarily diarrheal, disappear at once. I have reason to emphasize the latter point, justified by many years of careful observation. The decomposition products of milk and food are also operative. In chronic diarrhea a careful inquiry may elicit a special article of food that is the offending factor. Fermentable foods, like chicken and game, belong to the latter class. All articles of food that burden the digestive functions excite peristalsis; hence when the latter is to be minimized, simple articles, like beef-tea, skimmed milk, egg-albumen, and scraped meat, should be the chief articles of food. In other words, seek, if possible, to confine the burden of digestion to the stomach. The chief element of success in diarrhea is intestinal rest, and many chronic forms have yielded to rest in bed and a limited diet. It is strange, but nevertheless true, that in an inflammation elsewhere the physician insists on rest, yet he permits the patient with diarrhea to jar his intestines in every conceivable way, and yet expects results from treatment.

Diarrhea in Children.—In infants it is practically always encountered in those fed artificially, and almost never in breast-fed infants. The maximum number of infants affected corresponds with the maximum atmospheric temperature (summer diarrhea). An organism similar to that causing epidemic dysentery in Japan has been found in the feces of children suffering from summer diarrhea. The source of the bacillus is a matter of conjecture, although contaminated drinking-water may be the source of infection. Caillé[22] emphasizes the following fact: "Diarrheas can generally be prevented if the bottle food is sterilized before the warm weather sets in." Acute intestinal indigestion in children is caused, as a rule, by food qualitatively or quantitatively at fault. *Cholera infantum* is naught else but milk poisoning from bacteria. In diarrhea in children the infection may be limited to the contents of the bowel only (gastro-enteric infection) or it may involve the intestinal lining (ileocolitis). A purgative and starvation cause immediate improvement in the former condition, while in the latter no such prompt improvement follows (Zahorsky).

Dyspepsia (Gastric).—Although a symptom, it is practically an acute or chronic catarrhal gastritis. Food, whether improper, eaten in excess, or improperly eaten, is nearly always the cause of the trouble, although in the chronic form it may be a local manifestation of a constitutional affection, such as blood impoverishment, kidney affections, tuberculosis, gout, heart disease, etc. Many severe organic affections of the stomach, such as dilatation, ulcer, and carcinoma, may be disguised by dyspeptic symptoms. In an analysis made of one hundred cases of dyspepsia (uncomplicated), I found that starchy food was chiefly at fault. My invariable custom in the treatment of dyspepsia is to interdict absolutely all articles of food containing starch until the dyspeptic symptoms have subsided; then to allow gradually one piece of toast a day, and, later on, several pieces, until the normal diet is resumed. Breakfast-foods and fresh bread hastily swallowed without being insalivated are the foods mostly at fault. "Chew," I tell the patient, after starchy food is allowed him, "chew even your breakfast-food, if you insist on having it; but only chew, and continue chewing until your food in the mouth is insalivated, which you can recognize by the sweetish taste, and then, and then only, may you swallow it." I no longer find it necessary to analyze the stomach contents in simple dyspepsia, as my results with the foregoing treatment usually suffice. In amylaceous dyspepsia malt preparations are useful. Thorough chewing of food, and even the use of chewing-gum, by promoting the flow of saliva, favors the digestion of starch in the stomach, which is checked when hydrochloric acid commences to be secreted. The dyspepsia in question may correctly be called *salivary dyspepsia*, insomuch as it is usually dependent on an insufficient secretion of saliva. The deprivation of bread is a hardship to most patients, considering that bread constitutes in health one-third of the total amount of ingested food. However, the deprivation is only temporary. Crust of bread, stale bread, and zwieback are supposed to be more digestible, owing to the conversion of starch into dextrose. The latter and crackers, however, must be avoided in order to logically apply the starch-free diet for the treatment of dyspepsia. One may recall the German proverb, that every man has the stomach which he deserves to have.

Dyspepsia (Intestinal).—An incontestable fact, demonstrated by modern methods, is that, in accordance with the universal law of vicariousness, the intestines can completely substitute the digestive functions of the stomach. Intestinal dyspepsia refers theoretically to some anomaly in intestinal digestion, with symptoms of tympanites, colicky pains, etc. Practically the majority of cases depend on gastric indigestion, the food passing into the intestines in an imperfectly digested state. Intestinal, like gastric, indigestion is usually excited by starchy foods ingested in excess, improperly cooked or masticated.

Dyspepsia (Nervous).—Normal digestion, even in healthy persons, especially after a large meal, causes many nervous symptoms, ranging all the way from irritability and malaise to slight depression, headache, and pressure. In the nervous dyspeptic such symptoms are accentuated, with local symptoms of indigestion (eructations, pyrosis, nausea, etc.). Such patients are miserable objects, and by refusing food and fearing food (sitophobia), the symptoms are further intensified. Nervous dyspepsia is a mere expression of general nerve exhaustion, and its diagnosis is absolutely positive by means of the stomach-tube, and relatively so by far less radical measures. The term nervous dyspepsia embraces a variety of gastric neuroses, viz., peristaltic unrest, nervous eructations (aërophagia), vomiting, rumination (merycismus), spasm of the pylorus and cardia, atony of the organ, incontinence of the pylorus and cardia, and secretory disturbances; hyperacidity, subacidity, absence of secretion (achylia gastrica). Sensory disturbances may be expressed as hyperesthesia or by pains (gastralgia). Hunger may be excessive (bulimia), occurring in paroxysms usually at night, the patient awakening with a feeling of faintness and pain which are relieved by food. Such patients usually have the so-called "empty feeling" (acoria). Others have no appetite (anorexia nervosa) and are usually very much emaciated. The symptoms of the nervous dyspeptic are present at one time and absent at another; there is no uniformity in the clinical picture, such as we observe in simple dyspepsia. Diversion inhibits and mental stress aggravates the symptoms. There is an element of nervousness in all chronic dyspepsias, insomuch as the cause persists, viz., an exhausted nervous system. I have resorted to every therapeutic resource without avail in many patients, yet after a brief residence in the country the symptoms disappeared, at once recurring after a return to the city. Such patients will tell you that when they are absent from their business in the country they can digest "cobble-stones." Observations like this suggest the cause of the dyspepsia. Two simple methods are available in diagnosis, viz., a partial rest cure and a dose of potassium bromid (*quod vide*). *Enteroptosis* as a factor in nervous dyspepsia must not be disregarded, for unless the visceroptosis is corrected, our treatment will prove futile (*vide* abdominal support in diagnosis).

Jaundice.—Catarrhal jaundice occurring suddenly in young people is frequently caused by an attack of indigestion, and symptoms of gastroduodenal catarrh may precede the icterus. Such symptoms are: loss of appetite, coated tongue, offensive breath, nausea, vomiting, and other dyspeptic disturbances.

Pica.—Dirt-eating in children is a perversion of appetite, also observed in animals, notably, young lambs. Such children eat ashes, plaster, chalk, slate-pencils, etc. Pica is observed in feeble-minded individuals, in those with a neurotic heredity, and in hysteria. It may be acquired as a result of mimicry, which later may become a habit. It is very prevalent among the natives of Jamaica. Neurotic and anemic girls working at trades will ingest large quantities of fuller's earth, clay, chalk, sand, etc. Some attribute pica to the effects rather than the cause of disease. Thus, pregnancy may create such perversions of appetite. Intestinal worms are associated with pica, either as a cause or as an effect. Dirt-eating, by interfering with the ingestion of proper food, results invariably in nutritive disturbances, anemia, and emaciation. The dirt may produce mechanic bowel obstruction, and perforations of the stomach or intestine have been noted from the hard material swallowed.

Toxemia* (Gastro-intestinal).—The intestinal contents are normally toxic, but this toxicity is augmented by bacterial action on certain kinds of foods. While the usual intestinal poisons are from bacterial fermentation, there are also poisonous albumoses, *i. e.*, intermediate products formed in the digestion of albuminous foodstuffs. In toxemia two conditions are assumed: either the absorption of normal products of digestion or the absorption of poisonous products in indigestion. In the norm the poisons are either not absorbed, or, if they are, they are made innocuous by the organs of defense, which arrest, transform, or eliminate them. This autoprotection may be equationally expressed: $D=\frac{PTA}{R}$. D, the disease, equals P, the poison, multiplied by T, its toxicity, multiplied by A, its amount, the product being R, the resistance of the individual. The liver is the chief organ of defense. The detoxication of indol occurs mainly in the liver, but this detoxication cannot occur if the hepatic cells are gorged with indol, which, in common with other epitheliated cells, are conceded to possess the power of absorbing considerable quantities of indol. The causes of toxemia are essentially an excess of food, indigestible food, and food that has undergone bacterial fermentation. Certain kinds of food in the presence of idiosyncrasy may provoke toxemia: eggs, shellfish, strawberries, wines, milk, etc. Many of the obscure neuroses, especially in children, are the result of chronic toxemia, and strict attention to the technic of eating and the character of the food ingested are of the utmost importance. In the condition described as *alimentary intoxication* by Finkelstein, and occurring in infancy, the following forms are recognized: (1) Choleraic form, evidenced by loss of weight and extreme collapse. (2) Hydrocephaloid form, with predominating nervous signs, suggesting tubercular meningitis. (3) Soporose form, characterized by deep sleep, which may pass into coma. (4) Dyspeptic asthma, marked by a peculiar type of breathing. The foregoing condition is precipitated by a quantitative or qualitative increase in the diet or the substitution of some other diet. Here the affection may be aborted by lessening certain constituents of the food, like carbohydrates or fats. More diagnostic is the withdrawal of all food, which is followed by a fall of temperature, with a clearing up of the mental condition. Our most reliable guide in the recognition of toxemia is the examination of the urine, in which there is an excess of *indican* and *ethereal sulphates*.

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* This subject is discussed in detail in my recent work, "Man and His Poisons," E. B. Treat and Co., New York, 1906.

Herter[378] has recently referred to *indolaceturia* as a symptom of chronic intestinal bacterial infection. The following test is employed to detect indolacetic acid in the urine: Add an equal volume of concentrated hydrochloric acid and then a few drops of a 0.2 per cent. solution of potassium nitrite, and if the test is positive, a rose-red color ensues.

Liver (Diseases of).—Hyperemia is a transient physiologic condition occurring after each meal, and depends on the rapid absorption by the vessels of the portal vein. It is accentuated in those who eat and drink to excess (especially alcohol), and is associated with indefinite symptoms, notably distress and pain in the right hypochondrium. *Liver cirrhoses,* while admittedly toxic (alcohol), may in the majority of instances be caused by the toxic products of indigestion, or from highly spiced food, the ingestion of which is common in tropical countries. A *fatty liver* is encountered in general obesity, the liver acting as a storehouse for fat. Alcohol is another factor.

Pancreas (Diseases of).—When the burden of starch digestion is thrown on the pancreatic secretion in consequence of incomplete insalivation, symptoms described under the name of *pancreatic dyspepsia* have been described. Such symptoms refer to fatty diarrhea, vomiting of fatty masses, and absence of indican in the urine. Acute and chronic pancreatitis have been traced to gastro-intestinal disturbances, the inflammation having extended to the pancreatic duct.

Stomach (Diseases of).—*Cancer of the stomach* has no definite etiology. The abuse of the stomach by food has been suggested, but not demonstrated. The fact is, a history of previous dyspeptic symptoms is rarely obtained, and when an individual of mature life presents himself with symptoms of indigestion without ever having suffered from dyspepsia, I always think of carcinoma. *Dilatation of the stomach* may be acute or chronic. Both may be caused by habitual overeating. The employees of breweries, who consume large quantities of beer, often suffer from this affection. I recall a case of acute dilatation the result of forced feeding through a stomach-tube. The latter fact must not be forgotten in coexisting general diseases, which predispose to dilatation by their action in producing muscular atony of the stomach.

DISEASES OF THE RESPIRATORY SYSTEM.

Meteorismus.—A frequent though unrecognized cause of dyspnea in cardiopulmonary diseases is acute dilatation of the stomach, the result of digestive disturbances. The accumulation of gas in the intestinal tract, notably the colon, acts similarly. The stomach, however, is chiefly implicated. Owing to the genesis of the dyspnea, I have called it *gastrectatic dyspnea*. Digestive disturbances are often masked by the associated symptoms, pressure in the precordial region, and dyspnea, which are relieved by eructations of gas. Some years ago I reported a case of gastroptosis and merycismus with voluntary dislocation of the stomach and kidneys.[23] The individual in question could easily dislocate his heart by buccal insufflation of the stomach. This case directed my attention to the influence of the stomach on the position of the heart, and it was often evident that the pressure symptoms and slight dyspnea on exertion of dyspeptics were caused by pressure of a dilated stomach on the heart. Often this fact could be demonstrated at once by the removal of ingesta and gases from the stomach with the tube; heart tones previously feeble became strong, pulse stronger, and the area of cardiac dullness, previously diminished and slightly shifted, was restored to normal. After eructations of gases from the stomach the foregoing differences may also be noted. To quickly detect a dilated stomach encroaching on the chest organs, one notes by percussion that normally the tympanitic sound of the stomach does not extend very far beyond the axillary line, and in dilatation it may be traced to the vertebral column. *Heart dislocation* may be recognized by a small area of dullness with bronchial respiration between the internal border of the scapula and spine, on the left side, which is intensified when the patient leans backward and disappears when leaning far forward (Figs. 7,8,9). For the details of this sign the reader is referred elsewhere.[24] The accompanying illustrations (Figs. 5 and 6) describe more fully than words the influence of a dilated stomach on the position

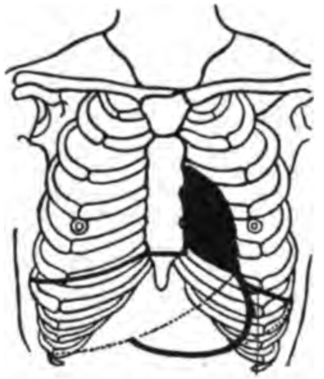

Fig. 5.—Effect of insufflation of the stomach on the heart: radioscopic appearance of the heart (dark area) and of the fundus of the stomach before insufflation.

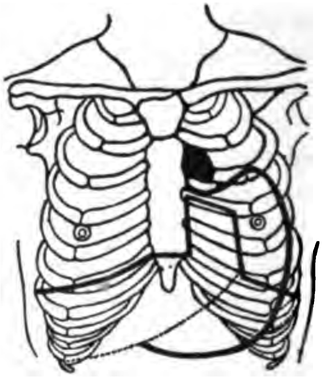

Fig. 6.—Appearance of the heart and fundus of the stomach after insufflation of the latter.

of the heart. They are reproductions from the fluoroscopic picture. In the average examination of the stomach with the *x*-rays, the stomach in contact with the chest is obscured by the shadow of the spleen. Such a shadow was not present in my patient and enabled me to study the dislocated heart. Similar studies[25] demonstrated that artificial insufflation of the colon is incapable of producing the same degree of cardiac luxation. Gastrectatic dyspnea is prevented by a correct dietary, which is discussed under food, in the etiology of diseases of the circulatory system. In the differentiation of meteorism Stark contends that when it is caused by swallowed air (aërophagy), the gas accumulation is limited to the small intestine, whereas if it is dependent on fermentation the gases are confined to the large intestine. Tympanites of the large intestine obliterates hepatic dullness, which is uninfluenced when the gases are confined to the small intestine.

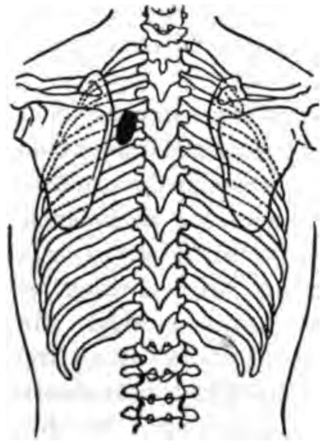

Fig. 7.—Patch of dullness in dislocation of the heart upward after insufflation of the stomach. Patient in the erect position. Also observed occasionally in pronounced cardiectasis. The dullness disappears when the patient leans forward and is intensified and increased in area (Fig. 8.) when the patient leans backward. Bronchial respiration may be heard over this dullness.

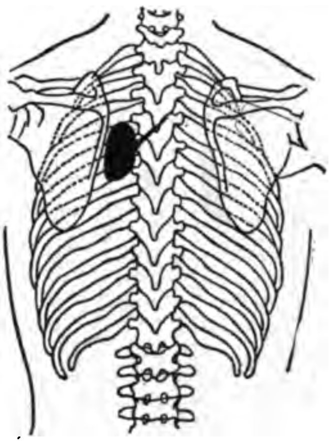

Fig. 8.—Same patient leaning backward, which increases the area of dullness and causes it to become more pronounced. This sign has occasionally been observed in extensive dilatation of the heart.

Asthma.—There are many individuals in whom asthma is provoked by indigestion (dyspeptic asthma) or by overloading the stomach or taking special articles of food, notably those that produce flatulency (carbohydrates). Symptoms of indigestion may be present or absent. A chemic analysis of the stomach contents should always be made to ascertain possible stomach trouble, even though a history of such trouble is not elicited. I have often inhibited an asthmatic paroxysm by means of an emetic or by lavage of the stomach. Intestinal worms may cause the trouble (asthma verminosum). Cases of urticarial asthma due to mussel-poisoning have been reported, and it is likely that in these instances there is a like urticarial enanthema of the bronchial mucosa.

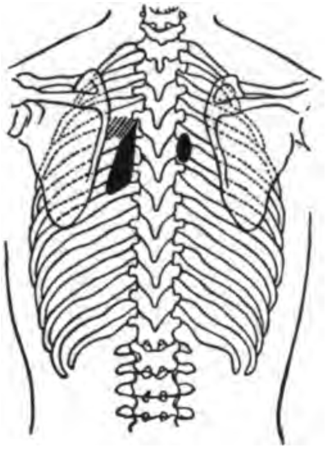

Fig. 9.—Shadow cast by normal heart (black area) and shadow cast by dislocated heart (shaded area) after insufflation of the stomach.

Bronchopneumonia may be caused by food and drink passing the rima and reaching the smaller tubes, where they excite an inflammation similar to that observed in vagus pneumonia after division of the pneumogastrics in dogs. In the foregoing instances the laryngeal reflex is abolished, as is observed in comatose conditions. Any difficulty in swallowing may cause particles of food to be aspirated into the bronchial tree (deglutition pneumonia), which may terminate in inflammation, gangrene, or suppuration.

Spasmodic croup may be provoked by an overloaded stomach, and the attack is often relieved by an emetic. Many of these cases of laryngismus stridulus are observed in rachitis, and are only checked by systematic treatment of the malnutrition.

Phthisis.—If a healthy stomach is one of the best guarantees against this disease, it is also one of the chief aids in restoring the diseased lung. In my experience, one of the best prognostic factors of phthisis is a stomach capable of digesting food. No matter how auspicious the symptoms otherwise, a rebellious stomach is always a bad omen. Good assimilation is proved by gains of weight. The feeding system, as embodied in the Weir Mitchell method for the treatment of hysteria, has furnished me with the best results in inaugurating the dietetic treatment of phthisis. This includes absolute rest in bed, with forced feeding, electricity, massage, and all the other elements of a *rest cure.*

DISEASES OF THE KIDNEYS.

Nephritis, especially the chronic interstitial form, is frequently caused by an excess of alcohol and overeating. The modern belief is to regard arteriosclerosis as the cause of the interstitial variety of the disease. In overeating four factors are involved:

1. The burden thrown on the kidneys is excessive.
2. Certain products are elaborated which irritate the kidneys.
3. An excess of food maintains high blood-tension and predisposes to arteriosclerosis.
4. Excessive taxation of the digestive apparatus, which, proving unequal to the task, permits bacterial fermentation and putrefaction, and the consequent development of toxins which are excreted by the kidneys.

Body-substance elimination by the various excretory channels has been divided by Hammarsten as follows: By the lungs, 32 per cent.; by the kidneys, 46 to 47 per cent.; by the skin, 17 per cent., and by the feces, 5 to 9 per cent. The kidneys excrete water, inorganic salts, and the nitrogenous compounds (urea, uric acid, hippuric acid, etc.). Many writers, notably Dieulafoy, have noted minor symptoms of Bright's disease, such as headache, temporary prostration, itching, muscular cramps, etc., which improve or become aggravated with modifications of the digestive anomaly. Favill[26] has reported undoubted cases of nephritis of gastro-intestinal origin. Nephritis following intestinal obstruction probably results from the products of intestinal decomposition. I have in several instances succeeded in causing albumin to disappear from the urine by the abdominal application of the sinusoidal current (*vide* this current in diagnosis). These cases resembled the cyclic forms of albuminuria. The relation of meat to the development of uremic symptoms in nephritis has been definitely established. In all forms of nephritis the ideal diet is milk, or as near an approach to it as possible. The approach to it refers to the addition of carbohydrates, which are absent from milk. In chronic interstitial nephritis the maintenance of the metabolic equilibrium may be of greater importance than an increase of albumin in the urine. Meat cannot be judiciously added to the dietary, for the reason that complications may be provoked, and for that reason we can obtain a uric-acid-free diet for a complete food from milk and cheese. Haig, in his book, "Diet and Food in Relation to Strength and Power of Endurance" (second edition), shows that a man weighing 140 pounds requires 1470 grams of albumin a day, and this is furnished by any of the following (Stahl):

TABLE I.

				Grams
10 ounces of bread	8	per cent. of albumin	=	340
2 " " oatmeal	12	" "	=	104
2 " " cheese	33	" "	=	281
18 " " fruit and vegetables	0.5–2	" "	=	152
1 " " nuts	16	" "	=	68
2 pints of milk	3	" "	=	525
				1470

TABLE II.

				Grams
5 ounces of bread	16	per cent. of albumin	=	340
2 " " oatmeal	12	" "	=	104
1 " " gluten	80	" "	=	344
1 pint of milk	3	" "	=	262
3 ounces of cheese	33	" "	=	421
				1471

TABLE III.

				Grams
3 ounces of cheese	33	per cent. of albumin	=	421
3 pints of milk	3	" "	=	787
14 ounces of potatoes	2	" "	=	120
16 ounces of fruit	2	" "	=	137
				1465

Many regard the retention of chlorids as an important factor in the cause of renal dropsy and consider that a pre-edematous stage may exist when the excretion of the chlorids is less than normal. Any increase of salt in the food of such patients may produce dropsy (*vide* diagnostic dietetics: salt-free food). The old idea that large quantities of water assisted in flushing the kidneys may still hold true, but if the kidneys are unable to excrete the water or in the presence of dropsy, water is harmful by raising blood-pressure and increasing hydremia. The latest theory explains hydremia in nephritis as follows: sodium chlorid is excreted in small quantities by the kidneys and the retained water is necessary for diluting the non-excreted salt. At any rate Widal shows that if the ingestion of chlorids be restricted, there is an immediate disappearance of the edema.

Albuminuria.—Albumin may occur in the urine transitorily after physical exertion, after a cold bath, after the ingestion of certain foods, especially raw eggs, and, being unattended by symptoms and only found accidentally, it is referred to as *physiologic albuminuria.* Then again there is a form known as the *albuminuria of adolescence,* occurring during childhood and puberty in anemic persons. It is often called *cyclic,* because it may be present at one time of the day (usually in the morning) and absent at another time. It is also called *orthostatic,* because it may be present when the patient is standing and absent if he be lying. Like the preceding, albuminuria of adolescence may occur after the ingestion of special foods, particularly proteids.

When albumin occurs in the urine, one of three conditions must exist: (1) Ingested albumin is not assimilated; (2) the renal cells do not hold back the normal proteids in the blood; (3) the albumin may have been derived from cells in the urinary tract. Some interpret physiologic albuminuria as a harmless condition; others consider that it is always of pathologic significance and the precursor of nephritis. Small quantities of albumin in the urine, appearing and disappearing, aggravated by exertion, foods, baths, etc., without casts in the urine, and without a decrease in the excretion of urinary solids, ought not to create anxiety, although the usual prophylaxis must not be neglected. If, however, we note, in addition to the above signs, a pulse of high tension, high blood-pressure, and an accentuated second aortic sound, there is no doubt of the existence of some organic change in the kidney. It must be remarked that there is a substance called *nucleo-albumin* found in normal urine which has certain reactions common to albumin and globulin, but it is neither one nor the other, although frequently mistaken for them. Nucleo-albumin appears as a slight cloudiness in urine which has stood for a time, and was formerly spoken of as a "mucous sediment." It is increased in inflammatory affections of the urinary tract. To distinguish nucleo-albumin from other proteids in the urine, add an *excess* of glacial acetic acid. If the urine becomes cloudy, especially if it has been previously diluted, nucleo-albumin is present. Previous dilution prevents the precipitation of urates. The presence of semen in the urine may be the source of albuminuria, and here the demonstration of spermatozoa in the sediment would reveal its origin; but, as a rule, spermatozoa cannot be detected. Slovstoff suggests the following test for the proteid peculiar to semen: the proteid in question is precipitated by a solution of sulphosalicylic acid, and the precipitate thus formed is soluble on the application of gentle heat.

Alkaptonuria.—This is usually a congenital and chronic condition, often affecting several members of one family. Alkapton urine may be mistaken for sugar because it reduces Fehling's solution, but, unlike sugar, it does not ferment and is optically inactive. No symptoms are present in this condition except pigmentation in various parts of the body, notably the ear cartilages. The urine is dark when passed, or turns dark on standing or upon the addition of alkalies. Alkaptonuria is supposed to indicate abnormal intestinal putrefaction, and is always more intensified after a meat than after a vegetable diet. Intestinal antiseptics and laxatives have no effect on its excretion.

Indicanuria.—Indol is formed in the intestines from the bacterial decomposition of albumin; when absorbed, the tissues oxidize it into indoxyl, which in turn unites with the potassium sulphate, and it is thus excreted in the urine as indoxyl sulphate of potassium. It is diminished on a milk and increased on a meat diet. Indol given to individuals by the mouth, even in small doses, produces frontal headache, irritability, nervousness, etc. Large doses produce insomnia and diarrhea. This subject is discussed under drugs in diagnosis (*intestinal antiseptics*).

Lithuria.—While gout is not common in America, writers describe a condition analogous to gout, without joint involvement, and call it *lithemia*, or American gout. It is attributed to excesses in the ingestion of food, drinking, and lack of exercise, although a nervous element must contribute to its genesis. The foregoing factors suppose that food is not properly oxidized and that the products of incomplete oxidation, of which uric acid is the type, accumulate in the blood. The chief symptoms are digestive plus nervous manifestations (irritability, depression of spirits), vague muscular pains, and the excretion of a scanty, highly colored urine, which deposits, on standing, a sediment of urates and uric acid, the so-called brick-dust deposit (lithuria). The deposit occurs especially in urines of high acidity. Lithemia, or the uric-acid diathesis, has been held responsible for almost all diseases from abasia to zoster. What we do know is that there is such a thing as disturbed metabolism, and it will produce an indefinite train of symptoms; and what we do not know is what constitutes the uric-acid diathesis and the offensive factors in the deficient oxidizing process. The remedy is evident—avoiding the factors which produce the condition. If one were guided in diagnosis by the urinary deposit, then almost every one has lithuria. Such deposits may be averted by a greater dilution of the urine, by drinking more water, and alkaline water if high urinary acidity is suspected.

Melanuria.—Urine is so called when it is dark when passed or becomes so after standing. A smoky tint is given to urine containing blood, but the most frequent cause is the presence of indoxyl sulphate. Although *indican* may be present in the urine in excess without revealing its presence to the eye, it may be of a bluish color when excreted or after standing. The bluish film on the surface of decomposed urine is due to the same substance. Certain dark-colored vegetable pigments, as bilberries and black cherries and plums, may blacken the urine.

Nephrolithiasis.—In kidney concretions the question of sub-oxidation in cause and cure (*vide* gout) is of importance. Calculi composed of urates suggest a mixed diet poor in carbohydrates, and alkaline waters to prevent the precipitation of urates in the urine. Oxalate of lime suggests a diet composed of animal food and restriction of starch and sugar. Calculi of cystin direct attention to abnormal fermentation in the intestines. Phosphatic calculi indicate that everything must be avoided which will make the urine alkaline and thus favor the precipitation of phosphates; hence a vegetable diet and alkaline mineral waters must be avoided. In nephrolithiasis distilled water has not only a solvent but a mechanic action. As much as two quarts of water should be swallowed in as short a time as possible (usually within an hour). Lilienthal employed the foregoing method of non-operative treatment with much success in a number of cases, and he would not think for a moment of advising an operation in a case of suspected renal calculus without giving the method in question a fair trial.

Oxaluria.—This may be associated with the so-called oxalic-acid diathesis, made up of a sediment in the urine of calcium-oxalate crystals, dyspeptic symptoms, and nervous manifestations (irritability, hypochondriasis, neuralgic pains, and neurasthenia). It may occur quite independently of the food ingested whenever the acid in the gastric juice is deficient. It occurs also as a result of excessive intestinal fermentation. It is probably an intermediate product of carbohydrate metabolism, and arises from excessive starch or sugar decomposition in the intestines. Cantani shows the relation between oxaluria and diabetes, and, in fact, both conditions may alternate in the same individual. Cantani describes another clinical picture in oxaluria, characterized by emaciation, furuncles, and abscesses. Oxaluria is often noted after the ingestion of food-stuffs containing oxalic acid, as tomatoes, fruits, cabbage, rhubarb, asparagus, spinach, celery, string-beans, carrots, pepper, black tea, cocoa, etc. Those who live on vegetables and drink large quantities of tea (poor people) are often subjects of oxaluria. Those who suffer from sexual disorders (functional) frequently show the crystals of oxalate of lime in the urine. It follows that the treatment of such patients is along dietetic lines, excluding articles of food containing oxalic acid.

Phosphaturia.—An excess of phosphates in the urine occurs in wasting disease of the nervous system, dyspepsia, anemia, etc. When the deposit takes place in the bladder, the whitish drops passed at the termination of urination may be mistaken for semen, and such patients often contribute to the revenue of quacks. Phosphates are said to be increased, although a quantitative analysis will often show that such is not the case. Phosphates may be mistaken for albumin. Eating and drinking excessively with little exercise lead to phosphaturia. In young men, phosphaturia is often associated with neurasthenic symptoms, and with restitution of nerve-health, the urine becomes less milky. Measures aiming to increase the acidity of the urine (diminution of vegetables, use of acids, increased ingestion of fluids) will prevent the precipitation of phosphates. When a deposit of phosphates is caused by ammoniacal fermentation of the urine (bladder and prostatic disease), urinary antiseptics (urotropin) and increasing the acidity of the urine (acid phosphate of soda in large doses) are effective. In phosphatic diabetes and in true diabetes there is a genuine increase in the excretion of phosphates.

DISEASES OF THE CIRCULATORY SYSTEM.

Food is variously implicated in accentuating many cardiac affections, whereas many cardiac neuroses are directly traced to anomalies in the digestive apparatus. Thus, **palpitation** of the heart is a common symptom in dyspepsia, and is frequently brought into existence by the use of tea, coffee, alcohol, and tobacco. In a large number of instances an irregular heart (**arhythmia**) is reflex from diseases of the viscera, and toxic from coffee, tea, and tobacco. A slow heart (**bradycardia**) is often encountered in diseases of the digestive system. A common cause of **angina pectoris** is some anomaly in digestion, notably flatulent distention of the stomach or colon. Overtaxation of the digestive apparatus signifies overwork of the heart. Huchard claims that in France the increase in the number of cardiac affections may be traced to an excessive consumption of meat. He also observes that the dyspnea present in diseases of the heart is not always due, as many suppose, to uremia, but to alimentary intoxication. Thus the suppression of meat and the use of a milk-diet will cause the dyspnea to evanesce, whereas a return to a meat diet will provoke a return of the latter symptom. We know the excellent results which can be attained by diet in relieving the symptoms of the **fatty heart** in obese subjects. The heart insufficiency often associated with the latter is caused, in part, by destruction of the myocardium by the accumulated fat, and in part by the excessive burden thrown on the heart. Muscularly strong individuals can tolerate a certain accumulation of fat without danger of heart insufficiency, but we know that, as a rule, obese subjects are muscularly weak. Cardiopaths must observe all the rules noted in correct eating. They must never eat or drink to excess, which may be avoided by proscribing the conventional meals, eating only when hungry, and consuming only digestible food; in other words, the diet should be as limited as is consistent with the demands of nutrition. The latter is roughly gaged by the weight. Easily digested food refers to food which does not tax digestion and does not tarry in the stomach. Foods belonging to the latter category are milk, chopped meats, eggs, meat-juices, certain kinds of fish, etc. Starchy foods must be absolutely interdicted in many instances, insomuch as they create flatulent distention. The method of food preparation must not be ignored. Cooked are more easily tolerated than roasted meats. Of the fats, butter is most easily digested. If bread must be used, then toasted bread or zwieback is indicated. Only cooked fruits should be permitted. It has been experimentally demonstrated that the work of the heart is influenced by the viscosity of the blood. Thus in dogs the work of the heart is four times greater when blood in lieu of water is permitted to traverse the blood-vessels; an exclusive diet of meat will make the work of the heart eight times as great. From this it follows, at least theoretically, that the greater the amount of fluid ingested, the less viscous the blood and the less the amount of work imposed on the heart. Practically it is difficult to create a dietary in conformity with the experiments. A vegetarian diet has been suggested, for it has been observed that vegetarians have a relatively slower pulse. A strictly vegetable diet may always be tried, but we must remember that an excess of such food taxes the muscular power of the alimentary canal, the strength of which is necessary in digestion, and when this is delayed, it undergoes fermentation (*vide* What to Eat). A milk diet is an ideal one. The idiosyncrasy toward milk may be overcome by the addition to it of tea, coffee, a little salt, cognac, etc. Its digestibility may be promoted by sipping rather than gulping it, and the addition of lime-water (1 ounce to a liter). Pasteurized milk retains the taste and odor of raw milk better than boiled milk. Limiting the ingestion of fluids according to the method of Oertel (thirst-cure) is only applicable in instances where the amount of fluid ingested is in excess of that excreted (*vide* visceral insufficiency in diagnosis). The use of alcohol in cardiopaths has been the subject of so much discussion that nothing practical has been evolved, and, after all, its use must be left to the discretion of the physician. Coffee contains about 1.2 per cent., and tea 2 per cent., of caffein; hence when the stimulating action of caffein is desired, coffee and tea need not necessarily be proscribed. The use of cathartics must be employed with much discretion, owing to effects already noted (page 54).

DISEASES OF THE NERVOUS SYSTEM.

Neuralgia has been defined as "the cry of a hungry nerve," and there can be no question that nutritional disturbances are the cause of many obscure neuralgic affections. Such disturbances refer to indigestion, intestinal toxemia, or the lack of nutritious food. Haig attributes migraine and many neuralgic affections to a diminished uric-acid excretion, hence a uric-acid-free diet may be tried when uric acid is supposed to be the offending factor. Trousseau observed that "migraine and gout are sisters." The rest-cure, which imposes an excess of nutritious food, is as surprisingly beneficial in neuralgias as it is in many forms of **neurasthenia.** In this respect Mitchell may be quoted: "Loss of fat is constantly associated with impoverished blood, and to gain in fat is nearly always to gain in blood." In **epilepsy** gastric troubles are common, and many attacks are precipitated by indigestible food. It has been noted that epilepsy is rare in the herbivora and frequent in the carnivora, and it has been shown that the attacks show a distinct relation to the amount of meat ingested. The absorption of intestinal toxic matter has been identified with the attacks of epilepsy, and it has been shown that methods of treatment aiming at asepsis of the alimentary canal have been productive of much good. Hamilton[27] affirms that hypertoxicity of the urine is found not only after an attack of epilepsy, but is occasionally a warning of its imminence. When the attacks were associated with gastro-intestinal disturbances, indican was increased in the urine. **Insomnia** is often dependent on deficient nutrition, gastro-intestinal anomalies, or eating before retiring. Marie and Bose have demonstrated that the urine of insane persons shows a toxicity which varies, and is more or less identified with the different forms of **insanity.** Dana[28] refers to the colon as an organ especially attuned to cerebral states. One cannot observe the apparently causeless recurrence of mania and melancholia without the conviction that behind it all is a disorder of metabolism leading to a toxic state. My friend, Dr. V. G. Vecki, in his work on "Sexual Impotence," refers to **loss of sexual power** as the result of excessive intestinal fermentation and auto-intoxication resulting therefrom. The systematic use of purgatives, he tells me, has cured many of his patients. **Tetany** is regarded by Albu as the most brilliant example of gastro-intestinal poisoning. **Narcolepsy,** a sudden uncontrollable desire to sleep, frequently encountered in diabetes, obesity, during acute infectious diseases, etc., is supposed to be due to auto-intoxication, and attacks of periodic vomiting have been attributed to the same cause. Kemp[29] studied the relations of the gastro-intestinal tract to nervous and mental diseases, and reference is made to the following abnormal products:

1. Ethylidenediamin, a ptomain found in gastric liquids in dilatation, which produces some symptoms found in Graves' disease.
2. Methyl-guanidin, resulting from putrefactive processes in the small intestine, which causes nervous irritability and convulsions.
3. Cadaverin and putrescin are ptomains found in the colon after constipation, and produce symptoms like muscarin poisoning.
4. Indol, which, when given to animals, causes cardiac and respiratory depression and spasms. Small quantities taken daily cause headache, colic, diarrhea, unnatural mental activity, and a tendency to neurasthenia.
5. Bile, when absorbed, produces a definite toxemia.
6. Cholin, which in large doses causes nearly instantaneous death in cats and rabbits.
7. Neurin causes labored breathing, unconsciousness, and convulsions.
8. Muscarin, which causes convulsions.

There is a chemistry of thought, and our varied mental states are modified by our food and its digestion. Verily, there is much truth in the aphorism, "Tell me what a man eats and I'll tell you what he is"; and, I may add with abject apology for the transposition, "As he thinketh in his alimentary canal, so is he." The neoplatonist, Porphyry, wrote: "It is not among the eaters of simple vegetable foods, but among the eaters of flesh, that one meets assassins, tyrants, and robbers." We have many drugs, like chloroform, morphin, atropin, cocain, etc., that produce hallucinatory types of insanity. Each poison acts differently in different persons. What opium has done for literature the writings of the self-confessed opium-eater, De Quincey, indicate. His articles are of the most bizarre nature, yet they are prose poems which are marvels in imaginative grandeur, and the most wonderful creations of their kind in English literature. In our gastro-intestinal canal putrefactive alkaloids are constantly manufactured which can duplicate the physiologic action of many of our well-known drugs, and in this way thought is influenced in a chemic direction. Some of the alkaloids are mainly derived from ingested foods. The alkaloids extracted have been strychnin, morphin, conium, digitalin, and nicotin-like substances.

DISEASES OF THE SKIN.

Many non-parasitic skin affections are influenced by diet. The most notable example is **urticaria** *ab ingestis*, which develops a few hours after the ingestion of certain articles of food. Individuals predisposed to the affection show an idiosyncrasy toward special aliments, viz., shellfish of all kinds, pork, sausage, highly seasoned meats, cucumbers, nuts, tomatoes, strawberries, mushrooms, etc. In all skin affections the dietary should be carefully supervised and all anomalies of digestion corrected. In intractable instances one is justified in attributing the affection to an enterogenic toxicosis, and should proceed to put the patient on an exclusive milk-diet and try intestinal antiseptics.

Bulkley, who refers **psoriasis** to errors of nitrogenous metabolism, observes striking results following the use of a vegetarian diet, not only as far as the control of the eruption is concerned, but in preventing its recurrence.

Diet in Chlorosis.—Not infrequently farinaceous food (which is poor in iron) is employed by foolish women for producing a pale complexion. The following table of Bunge shows the percentage of iron in different kinds of food:

FOODS WITH THEIR IRON-CONTENTS.

100 Grams of:	Percentage in Milligrams of Iron.
Rice contains	1.8
Rye contains	4.9
Wheat contains	5.3
Corn contains	3.6
Potatoes contain	2 to 6.4
Peas contain	6.6
Beans contain	7.4 to 8.3
Lentils contain	8.3 to 9.5
Apples contain	13.2
Spinach contains	35.9
Cow's milk contains	2.3
Beef contains	4.8 to 16.6
Eggs contain	5.7
Fish contains	1.5 to 84.2

IV. METHODS OTHER THAN DRUG-GIVING IN THE ETIOLOGY OF DISEASE.

Blood-letting.—Abstraction of blood for therapeutic purposes, by either leeching or venesection, should be preceded by inquiry respecting the history of the patient. Surgeons prior to an operation rarely investigate this subject, nor do they determine the coagulation time of the blood. There is a constitutional hereditary or acquired disease, known as *hemophilia*, which attacks certain members of a family, usually males, who are bleeders. The Anglo-German races are chiefly affected, and the subjects present all the evidences of health. There is nearly always a history of severe hemorrhage from some insignificant wound or occurring spontaneously (epistaxis, hematuria, ecchymoses). In leeching, the bite of the leech leaves a permanent scar, hence the spot selected must not be conspicuous. Leeches must be applied adjacent to and not over the site of the inflammation. Loose cellular tissue, like the scrotum and eyelids, must be avoided. The leech, according to its variety, draws from 1 to 3 drams of blood. Salt is especially repugnant to the leech, hence they release their hold on a part upon sprinkling them with salt. If they have migrated to the vagina or rectum, a salt solution will dislodge them. Leeches secrete an anticoagulating substance, and hemorrhage in consequence has often been troublesome; for this reason they must be applied preferably over a region where pressure can be used to control bleeding.

Venesection is usually carried out by opening the median cephalic vein, which is external to the tendon of the biceps. The median basilic is not selected, because it is near the brachial artery, which may be injured. The patient should be in the recumbent position to avoid syncope. The latter is often caused by the sight of blood; hence in the technic, distribution of the blood must be avoided and the patient's head directed away from the site of the operation. The amount of blood withdrawn should never exceed 3 grams per pound of the body-weight, although 1 gram to the pound of weight of the body is a safer rule. The amount of blood has been reckoned in adults to be equal to about $\frac{1}{13}$ of the weight of the body, *i. e.*, about 5 kilograms of blood. Naturally, the operation must be done with due regard to asepsis. Syncope, or even faintness, suggests arrest of the operation, at least temporarily. The blood in the subcutaneous tissues is soon absorbed. Wound infection and thrombosis almost never follow the operation.

Coagulation time of the blood may be determined by placing a large drop of blood on the center of a clean, dry, glass slide. After a couple of minutes, tilt the slide on end. If the blood is completely coagulated, the profile of the drop shows a blunt cone; otherwise, it is tear-shaped. The tilting is repeated at intervals until the coagulation shape appears. Complete clotting occurs normally in about five minutes.

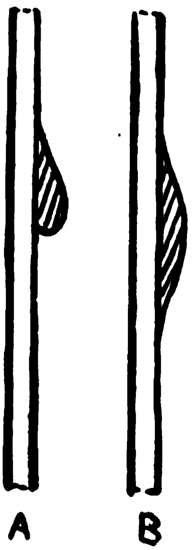

Fig. 10.—A, Incomplete coagulation (tear-shaped drop); B, complete coagulation (convex drop).

Ciuffini employs the following method for studying the coagulation of the blood: Ten smooth glass test-tubes, 8 cm. long, with an inner diameter of 8 mm., the glass walls 0.5 mm. thick, are placed upright in a standard, and 1 c.c. of a 0.9 per cent. saline solution is placed in each tube. One drop of blood drawn from a vein in the arm is added to the first tube, 2 drops to the second, 3 to the third, and so on. Each tube is then closed with a rubber stopper and the contents mixed. The minute when the blood is added to each tube and the minute when coagulation occurs are recorded for each tube. The normal average was found to be from seven to ten minutes in the tubes with from 7 to 10 drops. In the tubes with from 3 to 6 drops the average was between twelve and twenty-five minutes.

Calcium chlorid, in doses of 10 grains dissolved in water, three times a day, is a prophylactic hemostyptic.

A simple *viscosimeter*, described by Denning and Watson,[211] and made by Hawksley, of London (Fig. 11), is used as follows: The lobe of the ear is first well cleaned with ether, and a special fine-pointed knife is then inserted into the most dependent part of the lobe. The viscosimeter, which has previously been warmed to the temperature of the patient's body, in much the same way as a clinical thermometer, is placed beneath the hanging drop of blood and the receptacle of the instrument is filled. The moving thread of blood is carefully watched through its course down the longer limb and round the bend of the tube; the second finger of a stop-watch, which has been held in readiness, is started as soon as the column of blood reaches the point *m'*, and is stopped the moment that it gains *m''*. The time, which will now be read off to one-fifth of a second, is that taken by a quantity of blood suffi-

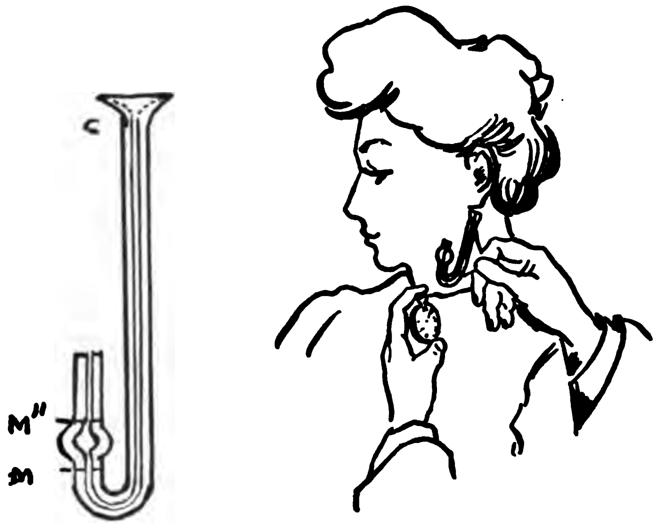

Fig. 11.—Clinical viscosimeter and the method of its application.

cient to fill the elliptically shaped bulb in flowing through the long capillary arm of the instrument. This time-value, when compared with that given for water, for which the viscosity is well known, gives us directly the viscosity coefficient of the blood. Observations on healthy people gave values ranging between 4.8 and 5.6 times that of water at blood temperature, whereas in pathologic states considerable variations were observed.

Catheterization.—Strict asepsis must be enjoined with reference to the instruments, lubricants, and urethra. For the instruments heat is the best method of disinfection, by boiling the metal instruments for at least five minutes and by subjecting the soft elastic instruments to steam. In lieu of steam for the soft instruments, the latter may be immersed in a sublimate solution. Liquid paraffin is one of the best lubricants, and if kept in a wide-mouthed bottle, the sterile instrument can be immersed in it without the use of the finger for spreading the lubricant. In the normal urethra many organisms are found. Prior to urethral instrumentation the glans and meatus must be wiped with a boric-acid solution after the patient has urinated; and to further carry out asepsis, the anterior urethra should be washed with sterile water. A previous injection of oil into the urethra will facilitate the introduction of the instrument. The meatus is the narrowest part of the urethra, and a meatotomy must often be done to permit instrumentation. Preputial edema may block the urethral orifice and incisions into the edematous preputium may be necessary. The instrument may become fixed in the urethral lacunæ or its further introduction may be impeded by a stricture. In such instances, if a hollow instrument is used, oil may be injected into it by means of a syringe with the instrument *in situ*, and its introduction will in this way be hastened. If the neck of the bladder obstructs, then the instrument is partially withdrawn and another attempt is made with the handle very much lowered. If the obstruction is caused by *prostatic hypertrophy*, a Mercier or a more curved instrument must be used. If the prostatic hypertrophy is general, the urethra is lengthened; hence in such conditions a longer catheter is necessary to reach the bladder. At the same time reference to Fig. 12 shows that the posterior urethra is more curved. Insomuch as difficulty of catheterization in these cases involves the posterior wall of the urethra, it is always a good rule, when catheterization is difficult, to keep close to the anterior urethral wall. If it is difficult to pass a stricture, introduce a filiform bougie up to the point of the stricture, fasten it, and permit it to remain in position from twelve to twenty-four hours; it will be found that after this time the bougie will pass without difficulty (Hock). In prostatic hypertrophy when urine must be withdrawn by self-catheterization, a soft-rubber catheter should be tried first of all; metal catheters should be avoided, as, even in expert hands, bleeding and false passages may result. The ideal instrument for catheterization is the elastic Mercier (Fig. 13). In enlargement of the *prostate gland*, exposure to cold may temporarily cause congestion of the gland and prevent urination. Here a hot sitz-bath, by relieving congestion, may render catheterization unnecessary.

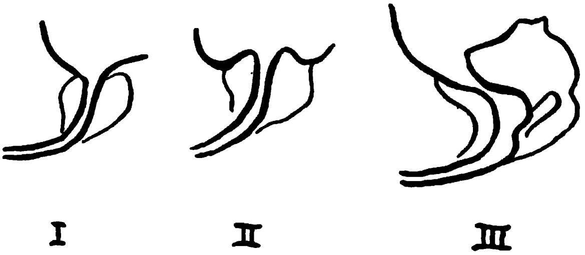

Fig. 12.—Course of the urethra in hypertrophy of the prostate. I, normal urethra; II, slight enlargement of the prostate (lengthening and deepening of the urethra and the fundus of the bladder); III, more pronounced grade of hypertrophy (bending of the urethra, sinking of the posterior wall of the bladder, and enlargement of the prostatic sinus) (Gumprecht).

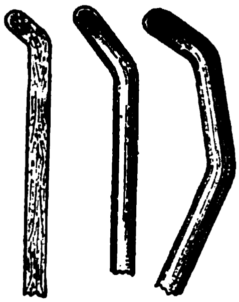

Fig. 13.—The elastic Mercier with different curves.

The "catheter life" of a patient with prostatic hypertrophy is determined by the amount of care employed to prevent infection, and is wholly a question of pedantic cleanliness. With the fingers introduced into the rectum, an instrument may be guided into the bladder. *Urethral spasm*, especially in nervous individuals, may delay the introduction. Patience in such instances is requisite, for by waiting several minutes the spasm usually yields. The previous local use of cocain or a large dose of potassium bromid may inhibit or prevent the spasm. Urethral hyperesthesia may be overcome by cocain. The usual method of anesthetizing the urethra is to inject about 1 c.c. of 2 per cent. solution of cocain, and this is distributed over the canal by manipulations of the fingers from without. Some advocate a 10 per cent. solution of antipyrin, which, while not as effective as an anesthetic precludes intoxication and profuse bleeding. The membranous portion is the most, and the prostatic urethra the least, sensitive. Sudden death has occurred after a single catheterization, but in such instances the kidneys were diseased. When the bladder is suddenly emptied, so are the ureters and kidneys, for the sphincters have yielded to the back-pressure. The sudden relief of intrapelvic renal pressure causes renal congestion with anuria, and many patients have died from suddenly emptying a chronically overdistended bladder. Hemorrhage following urethral instrumentation, if slight, is almost unavoidable in elderly people, in whom the prostatic urethra is in a condition of hyperemia. Severe hemorrhages usually indicate the creation of a false passage. If the rare condition known as bladder hemorrhoids (varicose veins) exists, the source of the bleeding may be the bladder. False passages are usually made in the posterior urethra in the lower wall, and may result in urinary infiltration of the urethral cellular tissue and extension to the pelvis with septic fever, the perforation itself being of comparatively little consequence. In the majority of instances a false passage may be credited to the carelessness of the physician.

Urinary retention may follow instrumentation, owing to irritation and consequent swelling of the mucosa.

Catheter-fever following instrumentation has been attributed to one of two causes—resorption of urine through urethral abrasions produced by the instrument, or some change in the kidney provoked by the maneuver. The fever is more often acute, beginning either within a few hours or it may be delayed two days. Lassitude and chills may precede the fever. The fever may last several days and then terminate with profuse perspiration. During the febrile period, the urine is diminished in quantity and may contain albumin and casts. In a few instances uremic symptoms and death follow. Chronic catheter-fever may succeed the acute form or be initiated as such. To thwart catheter-fever, about 10 grains of urotropin or a little amount of quinin may be given before instrumentation; in fact, when the patient has never had an instrument introduced into the urethra, this is a wise procedure. Guyon, in the presence of catheter-fever, puts a permanent catheter into the bladder, which frequently inhibits the paroxysms.

Electricity.—In electrotherapeutics we achieve results psychologically as well as physiologically. The one who is a convert to the psychologic theory provides himself with gorgeous apparatus, operates in subdued light, so that the patient may have all the benefits of the spark-effects, and so manipulates the application that slight physiologic action is produced. It is with the best understood galvanic current that we are now dealing. The specific polar effects of this current must be recalled, viz., that the anode or positive pole is soothing, and that the kathode or negative pole is exciting. In the percutaneous application, *i. e.*, to the unbroken skin, a burning sensation indicates either that the current is too strong or that the electrodes are not sufficiently moistened or that the metal of the latter is in direct contact with the skin. Redness, vesication, and even ulceration of the skin may occur if the physician disregards the burning and pain felt by the patient. Such sensations indicate that the current is too strong. The current must only be applied to the mucous membranes with great caution, owing to the cauterant effects of the current. Hysterical attacks have frequently ensued from the application of the current to the head and neck. Ordinarily the application to the head or neck, by stimulation of the optic, auditory, or lingual nerves, causes flashes of light, buzzing in the ear, and a galvanic taste on the tongue; dizziness and other peculiar head-sensations are experienced. Such physiologic effects are accentuated if the electrodes are shifted, if the current is interrupted, turned on rapidly, or if the poles are reversed. A good galvanometer is indispensable with this current, and we are able to avoid the foregoing effects if the needle of the galvanometer is watched and is observed to move evenly and slowly in one direction. The electrodes must not be removed until the current is turned off completely. Well-soaked electrodes assist in the prevention of skin-effects and permit of the penetration of the current. The epidermis has a greater resistance than all of the tissues put together, and is practically an insulator.

Persons show an idiosyncrasy to electricity as well as to drugs, which must be respected. Some are made more irritable, others suffer from headaches, chills, and perspiration. The effect on special nerves may continue for several days after the application, viz., buzzing in the ears, flashes of light, and a coppery taste. In such instances it is unwise to continue electric treatment. The system can be habituated to electricity just as it becomes tolerant to drugs, hence in early applications it should be given in small dosage. Age and sex influence dosage, and the same rules governing the administration of drugs should be observed in the application of electricity. There is no reason other than an esthetic one why electric treatment should be suspended during the menstrual period.

Esophageal Sound.—After the passage of a sound through a stenosis of the esophagus, the patient may complain for several days of a peculiar sensation, either in the back or in the sternum, corresponding to the site of the stenosis. Dysphagia and even pyrexia may follow the use of the sound. The dysphagia may be relieved by aid of some local anesthetic (eucain) injected into the esophagus through a tube. The same maneuver will aid in relieving the dysphagia of such patients whether the sound has or has not been used. The ptyalism associated with the use of the sound may cause the entrance of saliva into the larynx. It is supposed that in carcinomatous stenoses inoculation of the cancerous material may occur in some traumatized part traversed by the sound. Hemorrhage may follow the use of the sound, and is to be feared. In esophageal disease with hemorrhage, however slight, the sound must not be used. Perforation may occur, but it is infrequent and can often be attributed to too much pressure exerted on the sound in its introduction. Spasm (esophagismus) may hinder the introduction of the sound, especially in nervous women. Here patience is requisite and no force must be employed. Small pieces of ice, injection of eucain, and the use of bromid may allay spasm. In such instances a thick may be more easily passed than a thin sound. A swallowing effort may momentarily release the spasm and allow the sound to pass, or, better still, a little water may be swallowed, which passes alongside of the sound.

Hypodermic Methods.—The hypodermic administration of drugs is indicated when rapidity of action of a drug is to be achieved, to secure correct dosage, to avoid disturbing the stomach, and to prevent changes of the drug in the alimentary canal. The dose of a drug hypodermically is about one-half of that given by the mouth. The most aseptic and satisfactory hypodermic syringe is made entirely of glass, including the piston. Gold, platinum, or platino-iridium needles are preferable when drugs like mercury are used. Among the disadvantages of the hypodermic method are: pain, persistent, painful, subcutaneous nodules, abscess, and danger of penetrating a vein. Pain may be avoided if a sharp needle free from rust is used and a part selected for injection which is not inflamed nor especially sensitive. The neighborhood of large vessels and nerves must be avoided. Previous spraying of the skin with some freezing substance (rhigolene, ethyl chlorid, or ice) may be used in very sensitive patients. Selecting a site where there is much subcutaneous cellular tissue will do much toward preventing any subsequent local reaction. The skin must be thoroughly cleansed before the injection is made with an aseptic syringe, and the puncture may be closed with collodion or adhesive plaster. The use of ether or chloroform for cleansing the skin produces simultaneously a mild local anesthesia. All air must be expelled from the syringe before injecting by inverting the instrument, and at the same time depressing the piston until a drop of the contained fluid exudes from the needle. The nature of the fluid injected determines the degree of local inflammatory reaction following the injection. The latter reaction is less likely to occur if the injections are intramuscular, especially in the gluteal region; the needle being plunged vertically into the muscular mass. If tablets are used for injections, boiling the water in a tablespoon by the aid of a match will assist in its solvent action, and at the same time furnishes a sterilized medium. Massage of the part subsequent to injection relieves the pain and obviates the tendency to nodulation.

Hypodermoclysis is a valuable therapeutic procedure for supplying the body with fluid and flushing the kidneys. Parts provided with plenty of loose cellular tissue are selected: interscapular and subscapular regions, breast, and abdomen. Not more than one dram to each pound of body every fifteen minutes should be infused; otherwise the tissues become soaked, for the kidneys are not equal to the emergency. Hypodermoclysis is contraindicated in all forms of dropsy dependent on cardiac or renal disease, in any tendency to lung edema, and, generally speaking, in high arterial tension, unless the latter is provoked by some form of intoxication. Naturally, antiseptic precautions must always be taken.

Subcutaneous injections of gelatin are now employed for hemorrhages and the treatment of aneurisms, and when a non-sterilized preparation has been used, infections and tetanic accidents have occurred. When in doubt about whether the gelatin is sterile, it ought only to be used by the mouth or rectum, although through these channels it is less efficient than when given under the skin. The use of Merck's *gelatina sterilisata pro injectione* is unattended by danger, and the initial pain of the injection may be relieved by the application of an ice-bag.

Hypodermic Relief of Dropsy.—Fine silver trocars with rubber tubes attached are thrust under the skin, and after this manner a few pints of edematous fluid may be disposed of in a day. The tubes and skin should be thoroughly sterilized. The available sites of puncture are the most dependent parts of the body. The parts adjacent to the trocars must be rubbed with some antiseptic salve and wetting of the skin prevented by layers of cotton. The ends of the tubes connected with the trocars must not remain *in situ* longer than thirty-six hours, to avoid wound-infection. The fluid should be allowed to drain slowly; too rapid a flow may be followed by cerebral symptoms, notably anemia of the brain (Klein). A troublesome symptom is the seepage of fluid after removal of the trocars. Very often the wounds can be made to heal by elevating the limbs and applying an antiseptic bandage. Owing to the danger from wound-infection by the use of trocars, the removal of subcutaneous fluid has been attempted in other directions. One of the best is to make deep and large incisions into the subcutaneous tissue under antiseptic precautions. Such wounds are decidedly more surgical than the small punctures made by the trocars. I facilitate the removal of the fluid by means of a cupping glass attached to a suction pump. Another method which I use is the following: two incisions down to the subcutaneous tissue are made on either side of the thigh just above the knee-joint; then an elastic bandage is applied, beginning at the foot, and extended upward to an inch below the incisions. The bandage forces the fluid toward the incisions, and may be removed and reapplied according to requirements.

Inflation of the Colon and Stomach.—Inflation of the colon from the rectum by means of air or carbonic acid is practically never attended by accidents. Von Ziemssen was unable to burst the large intestine in fresh cadavers by excessive inflation. Pathologic conditions, however, modify results. Thus, intussusception in children has frequently been cured by inflation or enemata and instances of rupture of the bowel have been reported. Inflation of the stomach may cause syncope, dyspnea, and reflex cardiac inhibition. I have repeatedly demonstrated the latter (*heart reflex*) by irritation of the gastric mucosa. The old method of distending the stomach by the evolution of carbonic dioxid from sodium bicarbonate and tartaric acid is open to the objection that the evolution of gas is not under control. A better method is to distend the stomach by forcing air into it through a stomach-tube by means of a Politzer bag. After this manner the amount of air introduced is under control. In any event, inflation of the stomach is contraindicated in feeble and elderly subjects, in cardiopaths, when there is any tendency to hematemesis or any suspicion of gastric ulcer.

Intestinal infusions employed for diagnostic and therapeutic purposes are best carried out by means of a rectal tube. The latter must be well lubricated and introduced by a boring motion; if it engages in a fold of the rectal mucosa, the introduction of the finger alongside of the tube will aid its further passage, or a little of the infusion allowed to run into the intestine will disengage the mucosa. The best position is the knee-elbow one, with the head low down, which reduces the intra-abdominal pressure. Another good but less effective posture is the dorsal one, with elevated hips. The knee-elbow posture is conducive to the retention of fluid. If the fluid fails to enter the intestine, either the end of the tube is obstructed by fecal matter and must be removed and cleansed, or the end of the tube is engaged in a fold of mucosa, and when the tube is slightly withdrawn and reintroduced, this maneuver enables the fluid to flow. By raising the height of the reservoir the inflow is aided. Reference has already been made to the difficulty experimentally of bursting the intestine, yet precautions must be taken, insomuch as when infusions are used we are dealing with pathologic conditions. The anatomic capacity of the large intestine is over 4 liters, but it has been found that clinically not more than 3 liters of fluid can be introduced. The pressure under which the fluid is introduced depends on the height of the reservoir containing the fluid, which should never exceed 4 feet. The danger of rupturing the bowels increases with the height of the reservoir. The recumbent posture must be maintained after introduction of the fluid.

Lavage.—The introduction of an excessive quantity of fluid into the *bladder* has been followed by rupture of that organ. The capacity of the bladder varies. Thompson maintains that from 60 to 100 c.c. of fluid can be introduced without danger. An excess of fluid may lead to dilatation of the bladder. The latter fact is of advantage when we seek to increase the capacity of a contracted bladder. Guyon suggests the use of the syringe for introducing fluid, insomuch as the experienced manipulator can determine by the sense of resistance the amount of fluid that can be tolerated. One must remember, however, that in the instances reported of rupture of the bladder the syringe was used. Lavage of the bladder without the use of the catheter, directly from the meatus, may be attended by accidents: irritation of the bladder, hematuria, conveyance of urethral germs into the bladder, epididymitis, and orchitis.

Lavage of the *external auditory canal* should be done with an antiseptic syringe and with an antiseptic fluid, for it is possible that a perforation of the drum exists, or the drum may accidentally rupture, and thus a dormant septic process in the middle ear may be excited. The water should be lukewarm. The force exerted in introducing the fluid should be slight. The end of the syringe should be round and smooth and not large enough to prevent the outflow. The pinna should be drawn upward and backward by the left thumb and forefinger, and the point of the syringe should rest lightly against the upper margin of the meatus and should point in the direction of the straightened auditory canal. After this manner the water will pass along the upper wall of the canal. Some dizziness following the washing is unavoidable.

The use of the *nasal douche* by the patient is a measure justly condemned by the modern physician, owing to the danger of the fluid passing up the Eustachian tube to the middle ear. Even the posterior nasal syringe in the hands of the physician has produced middle-ear inflammation. The atomized spray has substituted the foregoing methods. Even after the use of the latter, the nose should not be blown in the usual way, but merely wiped; otherwise, with the nostrils closed by the handkerchief, some of the fluid escapes by the posterior nares. All instrumental aids must be avoided in acute affections of the nose and throat. One must bear in mind the danger of infecting neighboring parts. Gargling after the method of Haug is efficient for cleansing purposes: Take a medium-sized mouthful of some antiseptic fluid and throw the head partially, not too far, backward, and allow the fluid to run by gravity slowly downward until the reflex irritation evokes a contraction of the muscles of deglutition, when the head is thrown slightly forward, and the contents expelled.

Stomach Lavage.—A flexible rubber tube (about 28 or 30, French), very smooth, with conical end, is selected. There should be two openings, one directly in the end, and the other on the side, about ¾ of an inch from the end (Fig. 14). For removing the stomach contents, a large tube is necessary. Although warm water is usually used as a lubricant, glycerin in some instances may be found necessary. Before introducing the tube, it is best to reassure the patient, informing him that some gagging and difficulty of breathing will be experienced. The latter is purely psychic, for it is practically impossible to introduce the tube into the larynx, for the reason that the moment a foreign body touches it, it closes reflexly. The patient is now seated with open mouth and head bent a little forward and instructed to practise deep breathing until the tube attains the stomach. Pass the tube into the pharynx directly over the center of the tongue, and the moment it reaches the pharynx, ask patient to make repeated swallowing movements, and during one of the swallowing acts push the tube gently downward until the mark on the tube (black ring) indicates that it has reached the stomach. The distance from the teeth to the cardiac orifice of the stomach is about 40 cm. (15¾ inches). It is easier to describe than to execute the foregoing maneuver. There are individuals with irritable throats, and others who are afraid of the tube. Throat irritability may be subdued by spraying the throat, and especially the root of the tongue, with a solution of cocain. Swallowing water before introducing the tube is often efficient. Pieces of ice in the mouth, allowed to dissolve slowly, may also reduce throat irritability. Rinsing the throat with a 5 per cent. solution of menthol or a 10 per cent. solution of potassium bromid is also efficient. To prevent nausea and vomiting, it has been suggested to cool

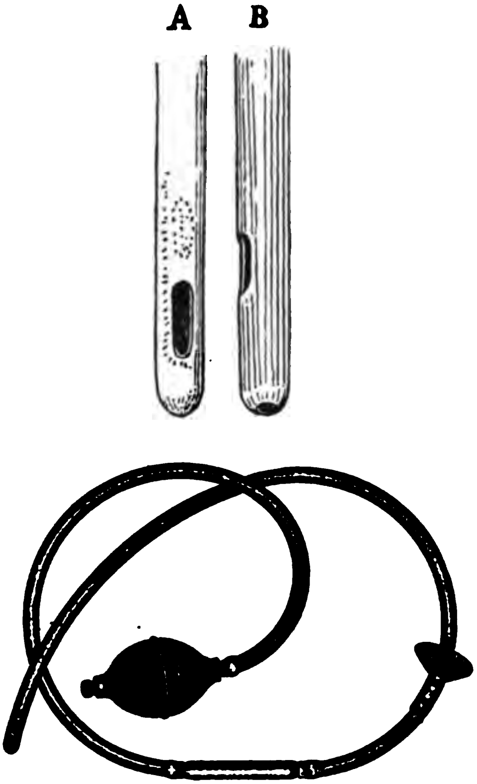

Fig. 14.—*A*, Stomach-tube with lateral openings terminating in a solid end; *B*, tube with terminal and lateral apertures; *C*, Davidson stomach-tube.

the end of stomach-tube with a spray of ethyl chlorid, or immersion of the end in ice is equally good. Should a fit of coughing ensue while the tube is being introduced, it is not always necessary to withdraw it. Very often a decided resistance, dyspnea, and gagging indicate that the tube is caught in one of the pyriform fossæ at the side of the larynx, where it rolls up like a spiral and appears as such at the mouth. Occasionally it is practically impossible for the physician to introduce the tube into the esophagus by the usual method, and in such instances I usually succeed by directing the patient to take a little water into the mouth and only to swallow when commanded. At the moment of swallowing the tube is thrust down quickly in the usual way.

Contraindications to the use of the stomach-tube are: severe cardio-respiratory diseases, aortic aneurism (danger of perforation), gastric affectiors associated with hemorrhage, gastric ulcer, and arteriosclerosis. During menstruation and pregnancy it is better to avoid the tube. Relative to the removal of the stomach-contents, some advocate the use of an aspirating pump. The use of the latter is not without danger, insomuch as the gastric mucosa may be aspirated and detached. The least harmful of all aspirators is that suggested by Kuttner (Fig. 15), which is practically a Politzer air-bag without any valve at the top. This aspirator is of value in two directions: (1) For aspirating the stomach contents, which is done by compressing the bag, and while so held, the nozzle is introduced into the end of the stomach-tube. (2) For removing food particles or mucus from the openings of the tube which prevent siphonage or the entrance and exit of fluid in lavage. In the latter instance the nozzle of the bag is fitted into the tube and compressed several times.

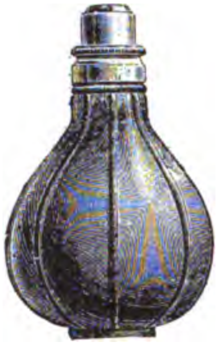
Fig. 15.—The Kuttner aspirator.

Storck[219] suggests the following method of obtaining the stomach-contents (Fig. 16): *A* in figure represents the stomach-tube in place in the patient's stomach; *B*, a glass T tube; and *C*, a piece of rubber tubing used for suction purposes. To the latter the lips of the operator are applied and gentle suction is made; or, a rubber bulb, *D*, is attached to the end of the tube. When suction is made by the operator's lips the free end of the T tube, *E*, is closed by means of the index-finger and gentle suction is practised. As soon as fluid makes its appearance in the glass T tube, the finger is withdrawn and the fluid is allowed to flow into a receptacle held in position to receive it. If the bulb is employed, it is first compressed, the free end of the glass T tube is closed by means of the index-finger, the pressure is then released from the bulb, and the fluid allowed to flow for collection. During the course of this procedure, care should be exercised to have the end of the stomach-tube to which the T tube is attached on a lower plane than the lower border of the stomach. The patient may be placed in the sitting or recumbent posture during this manipulation.

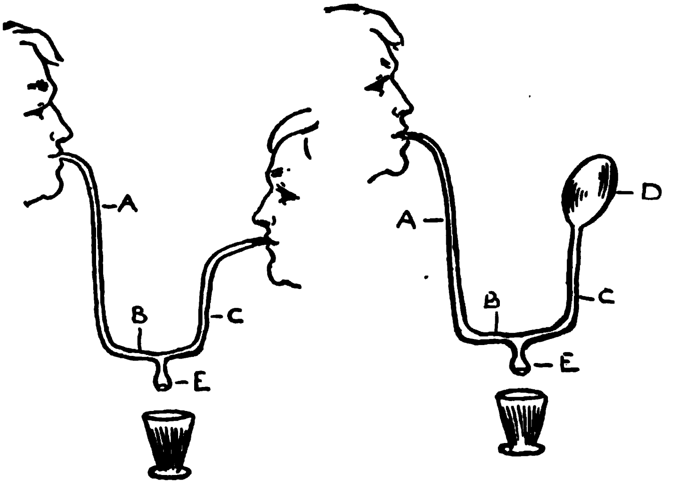

Fig. 16.—Illustrating the method of Storck.

Lavage in infants and children is done with a soft-rubber catheter, No. 12 or 14, or larger when large curds are to be removed. It is a simple and satisfactory procedure if the child is properly held in the lap of the nurse and a gag is used. In every instance of gastric lavage, measure the quantity of fluid introduced and note that approximately the same quantity is removed, otherwise subsequent colicky pains will interfere with the comfort of the patient. If the patient persists in biting the tube, a mouth-gag is indispensable.

The latter may be used in children or the insane, or a tube may be used through the nose (*vide infra*).

In acute or chronic dilatation of the stomach, the removal of all the stomach-contents is often difficult, and it has been suggested to practise lavage with the pelvis elevated or in the knee-elbow posture. Despite all efforts the tube becomes engaged in the pharynx and will go no further. In such instances the maneuver of Hueter may be employed: with the index of the left hand the tongue is pushed forward and downward, during which time the tube is introduced. Three cases of poisoning from antiseptic solutions left behind in the stomach are reported by Fenwick, and the latter urges greater care in filling and emptying the stomach, to avoid syncope and sudden death, which may occur from changing pressure on the abdominal plexuses of the sympathetic. A number of cases of tetany with a mortality of 72 per cent. after lavage of the stomach have been reported.

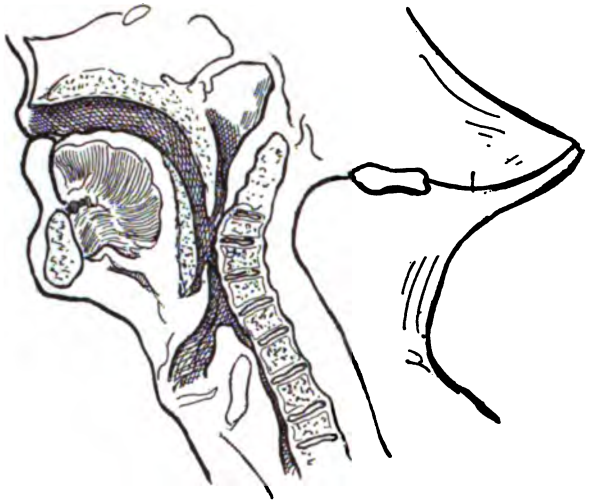

Fig. 17.—Topography of the commencement of the esophagus and comparative picture for the maneuver of Hueter.

Forcible feeding is often necessary in coma and the insane. The usual method is by means of the stomach-tube introduced by way of the mouth or nose. The latter route is usually unnecessary if the patient can be prevented from struggling and a good mouth-gag is used. When the nasal route is employed, a soft catheter (No. 10 or 12), about 24 inches in length, is used, to the end of which a glass funnel is attached. The patient is seated with head slightly bent forward. The catheter is then passed into the more patulous nostril until the stomach is reached. Care must be taken to prevent the tube passing forward into the larynx: a strident cough or cyanosis indicates the latter possibility, and one must withdraw the tube. If the patient can say "Ah," we can be sure that the catheter has not passed into the larynx.

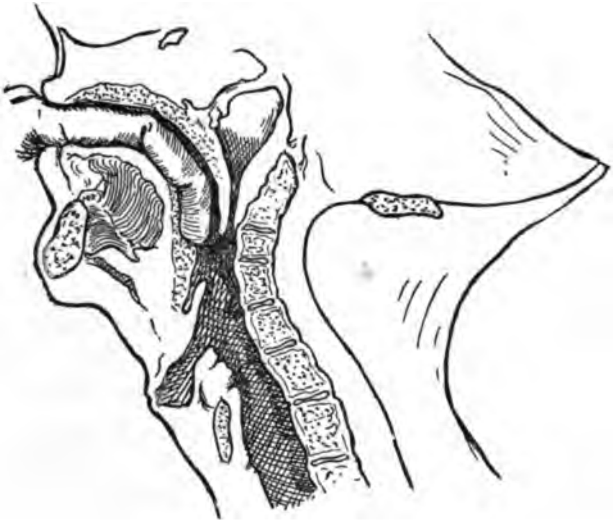

Fig. 18.—Position of the mouth and pharyngeal structures after executing the same maneuver.

Urethral Lavage.—As practised in the treatment of urethritis by means of the syringe or otherwise this demands certain precautions. Before each washing the patient should urinate to dislodge secretions, which otherwise would be conveyed from the anterior to the posterior urethra. Warm fluids should be used, as cold solutions set up local irritation. When injections are used, the penis can be compressed so that the injected fluid cannot pass beyond the point of compression. In washing the urethra the same maneuver should be practised until the anterior urethra is clean, and then only is the irrigating fluid allowed to reach the posterior portion of the canal. The syringe must be kept scrupulously clean, otherwise there is always a possibility of auto-reinfection. Urethral instrumentation must never be practised during the acute stage of a gonorrheal infection. I know of several fatal cases of gonorrheal systemic infection resulting from a failure to heed this injunction. Treatment must be temporarily suspended in the presence of acute complications (cystitis, epididymitis, prostatitis).

Uterine lavage is a procedure not unattended by considerable risk, for one must not forget that there is an open communication between the uterus and the general peritoneal cavity through the Fallopian tubes, and that fatal peritonitis has resulted from injections into the uterus.

Vaginal Lavage.—The ante-partum and post-partum douche should be used only when the parts are already infected. At one time it was supposed that all vaginal secretions contained pathogenic organisms. This view has been dispelled by accurate investigations, which show that the normal secretions are aseptic and even bactericidal. More recently Baisch[801] compared labor cases which were given a douche of one quart of bichlorid (1:1000) immediately before labor with cases in which the douche was not used. Of the cases treated with the douche, 12.8 per cent. had puerperal fever, as compared to 8 per cent. of those not treated. Bacteriologic study of the lochia showed a much greater number of streptococci in the douched cases, while the harmless bacteria were much diminished. The author concludes that antiseptic douches increase the liability to septic infection.

Operations.—Surgical operations conduce to, and are likewise influenced by, disease. Aside from the direct effects of the anesthetic (*vide chloroform* and *ether*), post-operative phenomena are not infrequent. Here many factors operate, notably fear of the operation, loss of blood, and shock. Many cases of *neurasthenia* date from the time of an operation, and so frequent is post-operative neurasthenia that I often advise unstable subjects to submit to a rest cure after an operation. *Insanity* may follow an operation, especially in operations upon the eye and castration. Operations during *gestation* may induce abortion, notably operations upon the rectum and vagina. It is advisable to avoid the menstrual period, to diminish shock and hemorrhage.

Surgical procedures may bring on the menopause prematurely, directly or indirectly. It is well known that menstruation ceases at once in about 90 per cent. of cases after removal of the ovaries, and that in extirpation of the uterus and tubes as well as the ovaries the percentage is greater. Menstruation may, however, be arrested temporarily or permanently by a surgical operation. We must also bear in mind the influence that the removal of a certain tissue will have on metabolism, whether the structure be the ovary, uterus, thyroid gland, spleen, or kidney. Even the removal of the uterus alone may precipitate the menopause, and it is even asserted that the uterus is not only a vehicle for the development of the impregnated ovum, but furnishes as well an internal secretion.

The influence of diseases on operations is largely a question of reaction to anesthesia. *Cardiac diseases* associated with cardiac enfeeblement belong to this category. The usual senseless method of cardiac auscultation for testing the efficiency of the cardiac muscle must be condemned (*vide* chapter on visceral sufficiency). Patients suffering from sepsis or hyperpyrexia, patients in collapse, and arteriosclerotics are very susceptible to narcosis. In the presence of pleural exudates great caution must be exercised in administering anesthetics; in fact, local anesthesia is always preferable. Here the mechanic interference with respiration and cardiac action is paramount, and in empyema there is the additional danger of sepsis. The *status lymphaticus* has been discussed already. Anemic individuals react badly, and likewise fat subjects, for in the latter we have the mechanic interference above noted as well as degeneration of the myocardium. In *diabetes* all operations are dangerous, the wounds healing badly and becoming the focus for a widespreading gangrene. Glycosuria may follow a surgical condition like an injury and sepsis, and may be made to disappear by an operation. In operations on diabetics the percentage of sugar is not a measure of the degree of danger: albuminuria adds to the danger, and the presence of acetone or ammonia in the urine gives a bad prognosis (Phillips). If a diabetic is in need of an operation, preliminary medical treatment will diminish the danger of the latter. Even a simple boil bears the unmistakable legend, *Noli me tangere*, and is better treated by diet than by the knife. Ether is preferred to chloroform as an anesthetic in diabetes. Operations are often unnecessarily delayed because some physicians want to first "build up" their patients. Very often the enervated condition is superinduced by neglecting surgical interference. I recall an anemic and poorly nourished patient who had adenoids, with periodic attacks of laryngospasm caused by the adenoids. The conservative surgeon to whom I sent the youth would not operate until the patient was first nourished, despite the fact that I insisted that his impoverished condition was due to the presence of the adenoids. Our polemic was interrupted a few days later by the death of the patient from a paroxysm of laryngospasm.

Surgical operations often exercise a beneficial effect by virtue of their suggestive action, although *anesthetics* must not be excluded in the results. Thus, in *epilepsy* the operation alone seems to have a curative effect. Osler reports fifty cases of trephining for epilepsy in which nothing abnormal was found to account for the symptoms, yet twenty-five were reported as cured and eighteen as improved. White has shown that even trivial operations remote from the skull, such as castration, circumcision, etc., have cured epilepsy.

Some contend that a child is rendered especially susceptible to *scarlet fever* by the shock of a surgical operation, and such fever developing after a wound or operation is known as surgical scarlet fever. The latter has a brief period of incubation, the rash is atypic, the throat may or may not be involved, and the nervous symptoms are usually severe. This affection must not be confounded with other cutaneous eruptions following an operation: notably vasomotor disturbances, caused by irritation of sensory nerves, which produce a transient urticaria or erythema; a toxic erythema caused by the absorption of drugs (carbolic acid, iodoform, etc.); and an infectious rash observed in septicemia and pyemia, caused by bacterial emboli lodged in the capillaries.

Puncture.—Accidents are associated with paracentesis for *ascites*. The flow is arrested and may be caused by fibrinous material obstructing the trocar. In such an instance the stilet may be reintroduced into the cannula or the fibrin dislodged by a sterilized probe or soft-rubber catheter. Often the fluid is below the level of the cannula, and then the latter must be pushed in different directions to attain the fluid, or the latter may be forced toward the instrument by pressure on the abdomen or by means of a towel, or the flow may be facilitated by a change of the patient's posture. An entire absence of flow may be due to encapsulated fluid, dense fluid, or excessive thickness of the abdominal walls (fat and edema). In the latter instance the trocar may not be long enough. A preliminary exploratory puncture should always precede paracentesis. To avoid syncope and collapse, stimulants should be held in reserve, the fluid must be slowly evacuated, and not more than 3 to 5 liters withdrawn at one séance. Syncope or collapse calls for an immediate arrest of the maneuver, at least temporarily. The presence of blood in the fluid, which continues to increase, must likewise stop the procedure. Peritonitis is an infrequent sequela and may be due to septic instrumentation or puncture of the intestines, which may happen if the exudate is small in amount or if the intestines are adherent at the site of puncture. In the event of intestinal puncture an immediate laparotomy is imperative. Infection rarely follows; indeed, Flint tells of a patient who frequently tapped himself with a jack-knife and used a clay pipe-stem for a cannula. The seepage following the puncture is often troublesome, and may often be avoided when, before removal of the trocar, the punctured point is compressed for several minutes by the finger around the trocar and then rubbed; or by a more certain measure—a deep suture. After the trocar is *in situ* and the stilet removed, a piece of sterilized cotton placed at the opening of the trocar will filter the air which may gain accidental entrance during variations in intra-abdominal pressure. To prevent puncture of the bladder the urine should be withdrawn by means of a catheter.

Paracentesis of the *bladder* is indicated in all instances of acute retention of urine when catheterization is impossible and an immediate operation cannot be done. For this purpose a very fine trocar, such as is used in pleural puncture, is employed and the bladder punctured at a point 3 cm. above the symphysis pubis. The needle is then connected with an aspirator. A larger needle is more likely to be followed by infiltration of urine. The procedure may be repeated very frequently without danger, and this special method is known as capillary paracentesis of the bladder. In lieu of suprapubic aspiration, repeated, if necessary, for the relief of retention of urine, Belfield passes without anesthesia a trocar and cannula (No. 14, French scale) into the bladder in the median line, about one inch above the symphysis; the trocar being withdrawn, a soft catheter (No. 8 French) is passed through the cannula far enough to carry its end to the bottom of the bladder. The cannula is then removed, leaving the catheter, which is attached to the skin by adhesive plaster.

Lumbar Puncture.—The technic is as follows: the patient is placed in the lateral posture and the body bent well forward to separate the spaces between the vertebræ. The spinal cord reaches only to the second lumbar vertebra, hence we select a site below that point for puncture. The site usually selected is just below the spine of the third lumbar vertebra, ⅓ of an inch to the right or left of the median line. The needle should be directed upward and inward, and before entering the vertebral canal the needle must penetrate to a depth of ¾ to 1½ inches in children and 1½ to 3 inches in adults. A line drawn from the highest point of one iliac crest to the other is exactly on a level with the spine of the fourth lumbar vertebra, hence the spinous process above the latter is the point of election for puncture. The absence of resistance shows that the needle has attained the canal, at which time the spinal fluid escapes drop by drop. In enfeebled subjects coughing may be necessary to start the flow. Should the needle strike a bone in entering, it need not be entirely withdrawn, but its direction must be changed. If the flow of fluid should cease, change position of the patient, move the needle in another direction, or introduce a wire to remove any obstruction in the needle. Many accidents have been reported from lumbar puncture. A violent headache or backache is frequent. Bleeding from the pial vessels is moderate. Many cases of sudden death following lumbar puncture have been reported, but in the majority of the cases the puncture was done for serious organic trouble which otherwise would have terminated fatally. The dangers of puncture may be minimized if the patient maintains the horizontal posture and if aspiration of the fluid is not attempted. There is always the possibility of cerebral bleeding if large quantities of fluid are removed. *Medullary anesthesia* has been followed by death and numerous accidents, and for that reason it is being generally abandoned. It is no doubt applicable in especially collected cases. Braun observes that old, anemic, and weak patients are remarkably free from untoward accidents in spinal anesthesia.

Paracentesis of the *pericardium* must take several anatomic facts into consideration. The thickness of the thoracic wall over the heart is about 20 mm. We must avoid puncturing the heart and the mammary arteries and accompanying veins, which are situated about a fingerbreadth from the right and left borders of the sternum. To diminish the resistance of the tissues a preliminary skin incision may be necessary. The entrance into the pericardium is usually recognized by the sudden diminution of resistance. The point of election in puncture is usually the fifth or sixth left intercostal space outside the mammary line, or the fourth right intercostal space, 3 cm. from the right sternal border.

Accidents associated with pericardicentesis are: injury of the lung and pleura, entrance of air into the pericardium, and infection. Many of the instances of sudden death reported are shown, when analyzed, to have occurred independent of the operation. Even though the heart is punctured, the danger is very slight, as statistics show, and we know that cardiocentesis was at one time practised to relieve engorgement. Reference to Fig. 20 shows that only a small area of the pericardium is in immediate contact anteriorly with the inner surface of the chest-wall, and is located where the anterior limits of the pleura diverge, close to the left sternal border, from the fifth to the seventh costal cartilage. Some advise making the puncture here in the fifth intercostal space, close to the sternal margin, so as to avoid injuring the left pleural sac. Bearing in mind this relation of the pericardium to the thoracic wall, the pleural cavity will not be opened unnecessarily in operations of the sternum and retrosternal region. The posterior pericardial wall has no reflection of mediastinal pleura, but is in direct contact with the connective tissue of the mediastinal space behind the heart. At this point a pericardial exudate may compress the esophagus

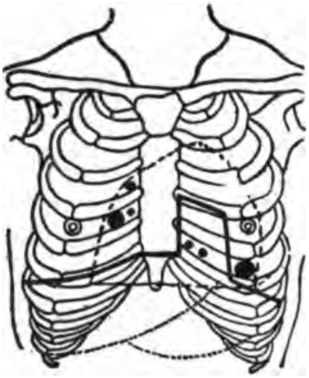

Fig. 19.—The chief (●) and less frequent (●) points of puncture in pericardial exudates. The interrupted line represents the usual figure of dullness in pericardial effusions.

and provoke dysphagia or vomiting, hiccough, and paralysis of the vocal cords by irritation of the vagus.

Puncture of the *pleura* for the removal of exudates should be preceded by the use of an exploratory puncture with an ordinary hypodermic syringe provided with a longer needle than usual and of large caliber. The syringe must be air-tight and its aspirating properties previously determined. An all-glass syringe with glass piston answers the purpose admirably. The exploratory puncture must be preceded by thorough asepsis and a site selected, if possible, where thoracentesis is subsequently to be made. The site selected, however, is of little consequence. No fluid may be withdrawn, yet an examination of the material in the bore of the needle may show pus-cells under the microscope. Very often the exudate may be too thick for aspiration through the hypodermic needle; then the method which I have suggested[31] may be used: The barrel of the syringe is first filled with sterile water, and after puncturing the pleura, the water is injected, which liquefies the exudate, and when aspiration is again made, the exudate can readily be drawn through the needle.

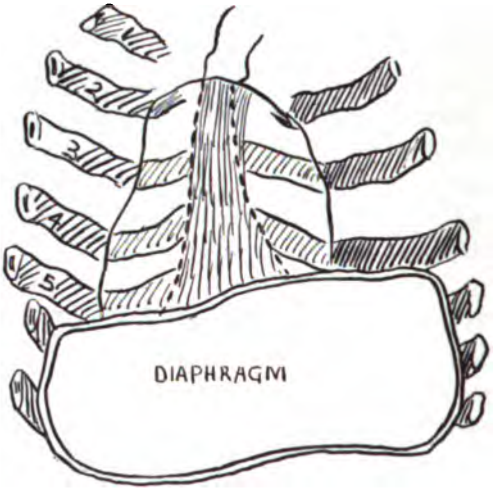

Fig. 20.—The anterior wall of the thorax with the pericardium. The dotted lines represent the anterior limits of the pleura, and between the latter at the fifth left costal cartilage is the usual site for pericardicentesis (after Schultze).

In *thoracentesis* the point of election for puncture is usually the fifth or sixth intercostal space in the anterior axillary line. This situation is selected because in this line the thoracic wall is the least thick (2 cm.) as compared with the thickness in the scapular line (4.3 cm.). As a rule, the operation is not performed below the sixth intercostal space in the posterior axillary line, although in the back the puncture may be made as low down as the ninth intercostal space. Naturally, the point of election is usually determined by the physical signs. The question of time is important to avoid accidents. Danger increases with the rapidity of removal. No more than one liter of fluid should be removed in twenty minutes. The quantity of fluid withdrawn in one séance should not exceed 1½ liters. Hemorrhagic exudates must be removed with much circumspection, insomuch as any lowering of pressure may be attended by fresh bleeding; hence not more than half a liter of such an exudate should be removed at one séance. Some suggest with good reason to precede thoracentesis by an injection of morphin to prevent pain, coughing, pleural reflexes, etc. The latter have followed the operation as well as after washing the pleural cavity or in changing drainage-tubes. Jeanselme[32] has collected forty-five cases. The chief symptoms are epileptiform convulsions with collapse, and among thirty-eight cases, death occurred in sixteen (Gumprecht). Sudden death has frequently attended or followed the operation, and even autopsies have not revealed the reason. Sudden deaths from pleural accumulations occur independent of the operation, and elsewhere in this book I refer to a patient whom I aspirated several times, and one day when I was preparing to perform thoracentesis, the patient suddenly expired. Death is most probably due to reflex inhibition of the heart (heart reflex) in consequence of a pleural reflex. Sponging or irrigation of the pleura has been followed by collapse and death. In investigating this subject, the following facts are pertinent: If the pulse is palpated in the average individual and pressure is made in any of the intercostal spaces, the pulse is retarded or even inhibited. If the skin over the area where pressure is made is anesthetized, there is no change in the pulse. The conclusion is evident: to avoid the pleural reflex all manipulation involving the pleura should be preceded by local anesthesia (personal observation).

An *albuminous expectoration* occasionally follows the operation. The sputa are of an edematous character, expectorated in very large quantities, and contain much albumin. The expectoration may be associated with dyspnea and cyanosis. In sixteen cases reported by Dieulafoy, six died. No adequate reason has been given for the expectoration. Fatal bleeding has occurred from puncture of the heart and an intercostal artery. Pneumothorax following the operation may be caused by too forcible aspiration causing a rupture of the lung, too rapid removal of the exudate, and faulty aspiration apparatus.

Subcutaneous emphysema may follow exploratory puncture of the chest, and in an editorial in the "British Journal of Children's Diseases" (September, 1905) thirteen cases of death (seven in children) are reported following the insertion of a needle in the chest-wall. The dangerous factor in all of the cases was the proximity to the chest-wall of firm, unyielding lung tissue.

Visceral puncture has been done in appendicitis when the object is to demonstrate the presence of pus. The danger of infection is not to be considered, as the tissues are already infected, but if the needle should pass through compressed intestines lying between the abdominal wall and abscess, the procedure is attended with great risk. Puncture of the *gall-bladder* is a risky procedure. Peritonitis and infection have frequently resulted, and oozing from the gall-bladder is a very constant phenomenon, as Körte has shown. *Intestinal puncture* has been done for the relief of meteorism. No doubt in the majority of instances there is no danger, for the intestinal wound thus inflicted closes at once. Autopsies have shown, however, that very often the punctured points become gangrenous and show evidence of peritonitis. Some years ago[31] I directed attention to a method of diagnosis which was specified as *parenchymatous aspiration*, and which I still use in visceral diagnosis. The method was first employed by me in the diagnosis of pulmonary tuberculosis where local signs of the disease existed without expectoration. A large syringe connected with a long hypodermic needle is used and a puncture is made into the suspected tissue, after which the solid tissue is aspirated. By pulling the needle back and forth and twisting it at the same time, it acts like a cork-borer, and then by aspiration, minute pieces of tissue for microscopic examination may be obtained. It is better to partially fill the syringe with a sterile salt solution and then puncture and discharge the contents of the syringe into the tissue; wait a few minutes and then aspirate. The contents of the syringe can then be examined under the microscope after staining. I first experimented with animals, and then, noting the harmlessness of the procedure, proceeded to employ it clinically. I have punctured the diseased lung hundreds of times, and the only bad effects noted were syncope in several cases, hemoptysis of one day's duration, and pain lasting a few days. By the foregoing method I have been able to demonstrate tubercle bacilli in the aspirated material from the lungs, lymph-glands, and joints. The spleen can be punctured to demonstrate the plasmodium malariæ. I have in a few instances made the diagnosis of amyloid liver by obtaining the microchemic reaction of the amyloid substance. The method is of undoubted value in leprous lesions of the skin, lymph-glands, and viscera. Many years ago I examined many patients at the leper hospital in San Francisco, and could easily demonstrate the bacilli of leprosy by parenchymatous aspiration. Similarly, visceral carcinomata are accessible to diagnosis. Now that the germ of syphilis has been definitely established, this method may prove of great value in demonstrating the spirochæta pallida in the inguinal lymph-glands.

Uterine Instrumentation.—The uterine sound is a useful instrument for measuring the length of the uterine cavity and to determine the position and direction of the organ. It is a dangerous instrument when used improperly and at inopportune times. It must be used cautiously to determine the mobility of the organ, because it is a powerful lever and may do injury to the uterine mucosa. Bimanual examination often suffices for determining mobility. All intrauterine instrumentation must be interdicted in acute inflammations of the uterus or its appendages. If the sound is skilfully passed, neither pain nor hemorrhage should ensue. Before any uterine instrumentation, ascertain the date of the last menstruation, for if the slightest suspicion of pregnancy exists, no instrumentation is permissible. Unhealthy secretions may be carried from the vagina into the uterine cavity, hence one must swab out the vagina before introducing the sound. It is better to introduce the sound with the help of a speculum, which separates the vaginal walls and enables one to reach the os directly. What has been said of the sound refers with all cogency to the curet, and in the use of both instruments cleanliness is imperative, and both instruments should be held lightly in the hand to determine the sense of resistance and to avoid injury to the tissues. Zweifel has shown recently that fluid injected into the uterus can pass into the tubes and set up a peritonitis, but if injected after massage or curetting the uterus, the entrance to the tubes will contract and no fluid can enter.

Vaccination.—The constitutional symptoms of inoculation are in proportion to the intensity of the local symptoms, and are most severe at, or a little before, the time when the areola has attained its fullest development (eighth day). The chief symptoms are pyrexia, digestive disturbances, and swelling of the axillary glands. An unusual symptom is a generalized, pustular rash. Complications may occur in debilitated subjects, and may consist of a variety of skin affections, ranging from erythema, urticaria, and erysipelas to septic infection, glandular abscesses, vaccinal ulceration, and gangrene. Vaccination should be done in early infancy, as infants are especially liable to infection. Vaccination should only be delayed in instances of acute illness. Antiseptic precautions should be employed, and refer to the instruments, the skin at the site of inoculation, and the subsequent treatment. Recently in San Francisco a vaccinated patient died from tetanus from accidental infection of the wound.

In cosmopolitan cities or when smallpox is prevalent, vaccination must not be delayed, for the delay of a single hour may signify the forfeiture of a life. The incubative period of vaccinia is three days (shorter than that of smallpox), hence early vaccination in those exposed to infection may prevent, or at least modify, the symptoms of smallpox. While it is possible that syphilis has been transmitted by the use of humanized lymph, the use of animal lymph makes the accident no longer possible. The transmission of tuberculosis from the calf is practically impossible. The ray fungus (actinomyces) has been found by Howard twenty-four times in ninety-five cultures from the virus of five producers in the United States. Many cases of tetanus have occurred, due in part to contamination of the wound and in part to contamination of the virus, in which the tetanus bacillus has been found. The latter accident is due to carelessness in the preparation of the virus, for it is well known that the bacillus of tetanus is commonly present in the intestines of cattle. Vaccination may aggravate the symptoms of certain disease, and in other instances it may bring into activity diseases like syphilis and tuberculosis, which have been quiescent. Osler reports a case of convulsions followed by hemiplegia at the height of the vaccination. Pertussis has been known to disappear within a few days after vaccination with ordinary calf lymph. Potassium tellurite has recently been suggested as an indicator to test the sterility of vaccine or serum.

***x*-Rays.**—In the early history of *x*-ray treatment and diagnosis long exposures were necessary, and consequently accidents were more frequent. With improved apparatus and technic the duration of exposure was reduced, until now accidents are infrequent, because we are able to employ protective measures against the baneful effects of the rays and administer them, like our drugs, in definite dosage. Among the accidents noted were *x*-ray dermatitis, burns, loss of hair, which often resulted in permanent alopecia, telangiectases, and various changes in the skin of an eczematous character. Among the other accidents of injudicious exposure to the rays are inhibition of muscular action, increased vasomotor activity, and defective vision. It has been shown that the rays may affect the subdermal tissues without any apparent skin manifestations. The rays are also concerned in the etiology of cancer. Thus, da Costa, of Amsterdam, noted the development of epithelioma seven times in seventy-one cases of lupus treated by the rays. Here the treatment consisted only of two séances a week, each séance lasting from five to ten minutes. One must observe, however, that an epithelioma may complicate lupus even without the intervention of the rays. Still, many cases are cited in the literature where neoplasms have unquestionably been traced to the direct action of the rays. Porter and White[364] have reported twelve cases of cancer following chronic *x*-ray dermatitis. All authors are not in accord concerning the primary point of departure of a radiodermatitis. Some contend that the rays act upon the cutaneous epithelium and connective tissue, whereas others claim that the latter lesions are consecutive to vascular lesions provoked by the rays. Warthin's[351] observations show that in the treatment of leukemia with the Röntgen rays the apparent improvement of the patient is often illusory unless the urine is constantly watched. Thus, in two cases treated by the rays which came to autopsy, the kidneys were occupied by calcareous deposits and the renal epithelium was necrosed.

A great danger among radiologists is the employment of the hand held before the tube in testing the latter. *x*-Ray operators are especially liable to these and other accidents, because after months of exposure the cumulative action of the rays becomes manifest. Among operators the *x*-ray effects are especially evident in the skin of the hands, which becomes indurated like scleroderma, dry, scaly, fissured, and ulcerated. The nails become dry and atrophied and may be permanently lost (Röntgenhand). Such a hand is liable to all kinds of infection and serves as a favorable field for the development of malignant growths.

x-Ray operators frequently suffer from nervousness, vertigo, headache, and cardiac palpitation. Such effects have been attributed by Butcher to the action of ionized air in the *x*-ray room. Even abdominal symptoms have been attributed to the rays, and Walsh cites the case of an *x*-ray worker who repeatedly exposed his abdomen to the rays, and suffered in consequence from pain, flatulency, and diarrhea. These symptoms finally disappeared by protection of the abdomen with sheet-lead. Experiments on animals with the rays will develop nephritis. More recently the effect of *x*-rays on the reproductive organs has been noted. It was found that the spermatozoa of a number of *x*-ray workers became diminished or absent, even though there was no previous *x*-ray dermatitis. Experiments on rabbits had previously shown that when the latter were confined in the *x*-ray room for several months, several yards away from the tube, these animals did not reproduce, and that the latter was caused by changes in the spermatozoa and testicular atrophy. It has been noted in several instances that individuals exposed to the rays for the treatment of pruritus ani showed failure to generate and atrophy of the testicles. Brown and Osgood[33] found that eighteen healthy laborers in an *x*-ray tube factory were without any spermatozoa, and that many of them had no children since operating *x*-ray tubes. The sterility thus induced is only the result of long exposures to the rays, and while it may be only temporary, the associated testicular atrophy is a foreboding of permanence. In the instances reported, the physical part of the procreative process was not disturbed. Relative to the influence of the rays in the female, apparently the same effects are produced. One observer, after using the rays in the treatment of fibromyoma of the uterus, noted cessation of the menses following atrophy of the ovaries, and experiments conducted on animals show that atrophy of the ovaries may follow exposure to the rays. Tousey's experiments on a pregnant cat demonstrated that death of the fetus *in utero* could be produced by exposure. Edsall and Pemberton[220] have reported three cases of acute intoxication following exposure to the rays, and two of these ended fatally. In one case a most severe reaction followed a single exposure. Elevation of temperature, nausea, vomiting, and prostration were the usual symptoms. Exposure to the rays causes changes in metabolism leading to increased tissue destruction, evidenced by an increase in the total nitrogen output. Histologic investigations show that the special tissues most severely affected are the bone-marrow, spleen, and lymphoid tissues. Insomuch as a special strain is put on the kidneys by the excreted products of the tissue breakdown, care must be exercised in the use of the rays in all instances where there is the least suspicion of nephritis or in metabolic disturbances.

The *physiologic action* of the rays is primarily on the cells, and matured cells respond less readily than those in the process of development. The white blood-corpuscles degenerate under the influence of irradiation. The epithelial cells are affected according to their vitality: the dead ones are unaffected, the matured ones are resistant, and the embryonic cells are first retarded in their development and then degenerate. It has been shown that the reaction of the tissues depends on the kind and amount of rays absorbed. The cathode become Röntgen rays after they strike the target, and when the latter strike the glass of the tube, and again the air between the tube and the patient, we have the secondary rays. The latter are more penetrating and show a less pronounced physiologic and chemic action than do the Röntgen rays. The exposed portions of the body (hands and face) react more quickly to the rays: blonds suffer more than brunettes, and the general susceptibility to the rays diminishes progressively from infancy to old age. According to Kienbock, the degree of reaction depends on the quantity of rays which strike the skin, and the duration of the period of incubation varies in inverse ratio to the strength of the dose.

Prophylaxis.—The apparatus should be installed in large and well-ventilated rooms, to avoid the continuous inhalation of ionized air. A good apparatus, including tubes which will limit the time of exposure, is essential. The operator may be protected by Röntgen-ray proof material which is now sold, consisting of apron and cap. The latter covers the head and face and is provided with lead glasses. Gloves are also used. Inclosing the *x*-ray tube in a shield of *x*-ray proof material will diminish the danger of *x*-ray exposure. Such shields are made of glass containing a high percentage of lead, having a window opposite the anode for the escape of the rays, and opaque shields. The former are preferable, for they permit one to watch the working of the tube. In all instances the operator must stand behind the plane of the anode to avoid *x*-ray exposure. An important question is the protection of the patient who receives treatment. Here the skilled operator is the most important factor, for he knows the physiologic and therapeutic efficiency of his own tubes. He knows the time required for each séance and how often the séances are to be repeated. The local reactions are recognized in their incipiency and further danger is averted. No practical instrument has been devised which will measure ray volume and quantity with accuracy. Until such an apparatus has been made practical, it is better to intrust Röntgenization to the adept operator.

The Benoist radiochromometer is generally employed to determine the penetration of the rays. *x*-Ray dosage is generally determined by color changes in chemical substances. Bordier's method is based on the action of the rays on barium platinocyanid, which changes successively from its original color (green) to yellow, gamboge, and deep maroon. The pastils are attached to the skin, and a scale of colors is supplied with tints corresponding to the principal reactions in *x*-ray treatment. As long as the pastil has not assumed the tint of No. 1, it is impossible, so it is claimed, to produce a lesion of the skin. The *x*-rays excited by a static machine are not less dangerous than those excited by a coil. The *x*-ray pictures obtained by the fluoroscope and skiagraphy are often misinterpreted, and such misinterpretation will be discussed later (*vide* Radio-diagnosis).

Radium.—It is generally conceded that the therapeutic action of radium is practically identical with the *x*-rays. The rays of radium are less effective, although more conveniently applied. Radium has the same baneful effects as the *x*-rays when used incautiously, causing, like the latter, burns and ulcers. Indeed, some claim that radium acts by virtue only of the *x*-rays it gives off. London[144] kept rabbits in a cage for sixteen months in which was suspended 25 milligrams of radium bromid. After sixteen days the ears became hyperemic, followed by loss of hair, ulcers, and general apathy. The spleen became shrunken, liver fatty, kidneys atrophied, and no spermatozoa were found in the testes. Ganglionic cells in the nervous system were atrophied.

CHAPTER III.

DRUGS IN DIAGNOSIS.*

(DIAGNOSTIC PHARMACOTHERAPY.)

Alteratives.—Analgesics.—Anesthetics (general and local).—Anaphrodisiacs and Aphrodisiacs.—Anticonvulsants.—Anthelmintics.—Antimalarials.—Antineuralgics. — Antipyretics. — Antirheumatics. —Antiseptics.—Antitoxins. — Carminatives. — Cathartics. — Cerebral Excitants. — Circulatory Stimulants. — Counterirritants. — Diaphoretics.—Digestants.—Diuretics.—Emetics.—Gastric Antacids.—Hypnotics.—Organotherapy.—Parasiticides.—Protectives.—Tonics.—Uric Acid Solvents.—Vasodilators.—Miscellaneous Drugs in Diagnosis.

The aphorism, "*Naturam morborum curationes ostendunt*" ("Cures show the nature of diseases"), is a fitting prelude to this chapter. A great clinician once said: "Medicine sometimes cures, it often relieves, it always consoles." Dubois, in his recent book, "The Psychic Treatment of Nervous Diseases," says: "Pharmacy somewhat resembles those arsenal museums where the catapult elbows the modern cannon, and it is like going there to choose our weapons. We are not very critical in our choice, but it does not seem to matter much, for we have fostered genuine medical superstition in our public." No discredit is cast on drugs in the foregoing statement; on the contrary, the author has perhaps unintentionally expressed the real objection to drugs: viz., lack of discrimination in their selection. In the first chapter the misuse, and not the use, of drugs was condemned. One frequently finds it difficult to charm ache with air and agony with words, and as far as myself is concerned, I would prefer an anodyne. Draper made the sapient observation that: "Mastery of all the sciences upon which medicine is founded does not make the physician. He would be helpless without them, but he is worse than helpless with them until he learns how to use them, how to construct out of them the special art which enables him to cure disease." Broussais observed that the real physician is one who cures. Geo. F. Butler relates the story of Dr. Allen, who was being shown through a large pathologic laboratory in Paris, and was wearied looking at shelf after shelf loaded with pickled specimens of organs and tissues from people long since dead. At last he turned to the great pathologist and said: "Great God! Where are the people you have cured?"

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*The toxic action of drugs is discussed in Chapter II. Reference is only made to the most reliable preparations, best adapted for therapeutic use. The doses mentioned are according to the U. S. P., for adults, and per os, unless otherwise mentioned.

ALTERATIVES.

Remedies belonging to this category change morbid conditions and modify nutritive processes while promoting waste. The exact manner of their action is unknown and their use is empirical. In this group of remedies, however, are included drugs of the greatest therapeutic value.

Arsenic.—In certain forms of anemia it increases the number of red blood-cells. It stimulates the appetite and nervous system and improves nutrition. The drug may be given for months if the dose is adjusted to avoid constitutional disturbances, the initial symptoms of which are conjunctival irritation and gastric disturbances.

Preparations.—Liquor potassii arsenitis, U. S. P. (Fowler's solution): Dose, 1 to 5 min., gradually increased to the point of toleration.

Arsenious acid: Dose, $\frac{1}{60}$ to $\frac{1}{20}$ gr. *Sodium cacodylate*, available for hypodermic use in doses of from $\frac{1}{3}$ to $1\frac{1}{2}$ gr., two or three times a day.

In *pernicious anemia* the action of arsenic is almost as specific in its effects as is the use of iron in chlorosis. Fowler's solution is given in doses of 5 minims, well diluted, after meals, until 20 or 30 minims are given daily. It is usually well tolerated by the stomach in this disease, but in the event that it is not, sodium cacodylate may be given hypodermically. In all of my cases the immediate benefit was marvelous, but unfortunately not lasting. In the event of relapse, arsenic may again benefit, but the rule in my cases was that it did not. One patient died after two years; another, after eight months; another, after three years; and still another, after four years. The others escaped further observation.

There are many forms of *anemia* which may be regarded as remotely related to this idiopathic form, which fail to be benefited by iron alone, and which yield to treatment only when iron is combined with arsenic. In such instances I use freshly made pills composed of arsenous acid (gr. $\frac{1}{80}$ to a dose), sulphate of iron (gr. 2), and extract of cascara sagrada (gr. 2 to 8) to prevent the constipating effects of the iron. One pill is given after each meal. *Glycerin* is an excellent excipient for pills; it prevents hardening and permits an equal distribution of the constituents. All observers agree that the most conspicuous action of arsenic is on the red blood-corpuscles, which are augmented in number. When water is mixed with normal blood, it destroys the red cells, but, if to the water arsenic in dilute solutions (1 to 400,000 parts) is added, such destruction is prevented. Gunn,[383] therefore, concludes that arsenic acts favorably in pernicious anemia by preventing the destruction of the corpuscles, and that in malaria it prevents the parasites from entering the red corpuscles and destroying them. Thus, Widal and Merklen observed in a girl with *chlorosis* several hours after a hypodermic injection of sodium cacodylate an augmentation of red corpuscles from 1,178,000 to 2,181,000. In all cases of anemia where the color index is high, suggesting the condition of the blood in pernicious anemia, arsenic should always be tried.

Chorea in children is not always characterized by typic involuntary movements; on the contrary, in chronic cases such movements are only noted during excitement. In other instances the child only presents the picture of restlessness, irritability, crying spells, anemia, and digestive disturbances. Such symptoms may often be recognized as choreic by yielding to arsenic, which is the most efficient medicinal agent we possess in chorea. The good effects are not noted until large doses of the drug are taken, or until the system becomes saturated, which is indicated by the premonitory toxic symptoms. When the latter appear, the drug may be suspended for several days and then given again. I have frequently given 20 minims of Fowler's solution to children three times a day. *Psoriasis* has been called a disease of the healthy. Its classic picture is readily recognized, viz., easily detached silver-gray scales, absolute dryness, the occurrence of reddish points of inflammatory thickening with defined borders which spread peripherally, and usually the absence of itching. Now, there are many skin lesions which are essentially psoriatic, although not recognized as such, and in such instances arsenic may be tried in large doses over a considerable period of time. It should not be given if there is much cutaneous irritation. The value of arsenic in psoriasis cannot effectually be tested with a course of less than three months (Hyde and Montgomery). In *pemphigus*, arsenic has often almost a specific influence. Next to quinin, arsenic is an efficient remedy in *malaria*, and in neuralgia of supposed malarial origin it is very beneficial. Perhaps much of this benefit arises from the fact that arsenic is a good antineuralgic. If we accept periodicity as a malarial manifestation, then all neuralgias must be malarial, for neuralgia is essentially a paroxysmal affection. The effects of arsenic on the enlarged glands in *Hodgkin's disease* are often surprisingly rapid. It is often difficult in the early stages of the disease to distinguish the enlarged glands of the neck in this disease from *tuberculous adenitis*. Here the therapeutic test with arsenic is available. True, some regard Hodgkin's disease and tuberculosis as identical, but there is little to justify this conclusion beyond the finding of tubercle bacilli in the lymph-glands of both diseases. The bacilli in question may be purely accidental. We must remember, however, that arsenic is an excellent remedy in *scrofula*, but the glands in the latter affection are never improved with such rapidity as those in Hodgkin's disease. The acutely enlarged glands in scrofula are often made to disappear very rapidly by inunctions of *soft green soap*. One dram is rubbed into the skin once or twice a day. The skin reacts readily, so that new areas must be selected for inunction, and the back is a preferable site. I can recall two patients who were about to be operated on for removal of the glands, and in one instance the enlargement disappeared after one week and in the other after three weeks' inunction of the soap.

Atoxyl (Meta-arsenic Anilid).—This is soluble about 1 in 6 of water, and is employed in this form for subcutaneous injection. The solution is warmed at the time of the injection in doses of ¾ grain to 3 grains. As atoxyl is comparatively non-toxic, large doses of arsenic can thus be given. Atoxyl has come into prominence as a specific remedy in the *trypanosome disease*. Recent observations of Ehrlich and Wendelstadt show that more efficient trypanocides are trypan red, malachite green, and parafuchsin. These observations open up a very important field in experimental therapeutics. They show that drugs may influence disease by combining either with the bacteria (bacteriotropic) or with the tissues (organotropic). Thus, methylene-blue is bacteriotropic when it is effective in malaria by uniting with the malarial parasites, and organotropic in subduing the pains of neuralgia by combining with the elements of living nervous tissue. Many trustworthy reports show that injections of atoxyl are not without good effects in many cases of *syphilis*, and while it is probable that atoxyl can never completely substitute the time-honored mercury, yet it should be given a trial in cases where mercury is not tolerated.

Colchicum.—The physiologic action is imperfectly understood.

Preparations.—Tinctura colchici seminis: Dose, 10 to 30 min. *Vinum colchici seminis*, 10 to 30 min.; *colchicin*, $\frac{1}{16}$ to $\frac{1}{30}$ gr., for administering in pills or capsules.

Colchicum is usually given with the citrate of potash or lithium. Colchicum is practically a specific in *gout*. The pain and swelling of the joints in acute gout are relieved in a marvelously short time. It is less efficient in chronic gout, and must be used cautiously in old and enfeebled subjects. There is a condition known as *irregular gout*, or the gouty diathesis or lithemic state, which is often unrecognizable until it is demonstrated to be such by the use of colchicum. Many cutaneous eruptions, especially eczema, occur in those with the gouty habit, and French physicians refer to them as the *arthritides*. Then, again, bilious attacks, arteriosclerosis, and urinary disorders characterized by an acid and highly colored urine, which readily deposits a sediment of uric acid on standing, have been referred to the same origin. Among pulmonary affections, chronic bronchitis is frequent, and eye affections, viz., iritis, retinitis, and glaucoma. Headache, neuralgias, and migraine are also associated with the gouty habit. Among other symptoms noted are hot or itching feet at night, cramps in the legs, and hot and itching eyeballs. When irregular gout is suspected, the tentative use of colchicum is indicated. In an inflammatory joint affection a bright red, shiny condition of the skin (if traumatism can be excluded) is very characteristic of gout. This skin change is rarely encountered in any other form of arthritis. Joint affections of gouty genesis are usually sudden in onset and occur at night. The metatarsophalangeal articulation of the big toe is the usual one affected, and the pain, as Sydenham said, "insinuates itself with the most exquisite cruelty among the numerous small bones of the tarsus and metatarsus, in the ligaments of which it is lurking." Some one said that the way to differentiate the pain of rheumatism from that of gout was to put the finger in a vise and then turn the screw until the pain was unbearable: that is rheumatism. Then give the screw an extra turn, and that was gout. While colchicum is a specific in gout, it is absolutely of no value in ***rheumatism***, hence the diagnostic inference is obvious. Some claim that there is such a hybrid condition as ***rheumatic gout***, whereas others refer to it as the refuge of the diagnostically destitute. The prevailing belief is that it is neither rheumatism nor gout, but a disease of infectious origin, although the theory is as yet unsupported by bacteriologic evidence.

Guaiacum (tincture, dose ½ to 1 fl. dr.) is recommended as a good substitute for colchicum in chronic gout and rheumatism. Garrod claims that, taken in the intervals of gouty attacks, it will prevent their recurrence. The drug has no bad effects, and may be taken continuously. Lucian, in his "Gout Tragedy" (*Τραγῳδοποδαγρα*), ridicules the pretensions of two physicians who vaunt specific remedies for gout, and in derision they are tortured by the affection until they cry for mercy. Now, as then, the atypic disease is an ***opprobrium medicinæ***. Bouhier, who was one of the immortals of the Académie Française, believing that gout was peculiar to philosophers, wrote a work with the following title: *Histoire des savants qui ont été sujets à la goutte.*

Gland Extracts.—*Vide* Organotherapy.

Iodids.—*Preparations.*—*Potassium iodid:* dose, 5 to 20 gr.; *sodium iodid*, 5 to 20 gr. There are two specific remedies in *syphilis*—potassium iodid and mercury. Other drugs are used, but the judicious physician will confine himself to the drugs mentioned. Syphilis is one of the most bizarre and protean of diseases, respecting no station in life nor tissue of the body. Respectability is often painted on a background of vice. We employ the iodids and mercury as therapeutic tests to determine whether a given lesion is or is not syphilitic. As a rule, one is justified in concluding that if the morbid manifestations respond quickly, the disease is syphilitic. To Alfred L. Loomis has been attributed the observation that he never saw any good effects in syphilis from potassium iodid unless the patient had previously had a thorough course of mercury. Many non-syphilitic lesions, however, also respond to the iodids, and in such instances we conclude that either a mistake in the etiologic diagnosis has been made, or that the benefit accrues from the alterative action of the drug. The latter, however, is improbable, for in many of the late lesions of syphilis (parasyphilitic affections), where the alterative action of the drug has free scope, little benefit is obtained. Naturally, we first search for evidence of syphilis. In the adult the history is misleading, for, like the hysterical, the syphilitic is given to prevarication. His secondary lesions may have been so trivial that they were overlooked. Then, again, syphilis is not the invariable product of venereal transgressions, for there are many innocent sufferers, notably women, who have been infected by their husbands, and there are thousands of others who have been extragenitally infected accidentally. Fournier found in his private practice that about 25 per cent. of the females had become innocently infected. A history of repeated attacks of urethritis may suggest an unrecognized urethral chancre. Scars on the genitalia, enlarged or small indurated lymph-glands, nodes on the bones, atrophy or hardening of the testes, a history of skin eruptions, sore throat, falling out of the hair, and, in women, frequent miscarriages, suggest syphilis. In *hereditary syphilis* the symptoms begin any time up to the sixth month. Fournier contends that hereditary syphilis may show itself at any age, a fact which is in opposition to those who deny a latent hereditary form of the disease. Nasal catarrh (snuffles) is one of the earliest symptoms. A novelist has described the syphilitic child as "a little old man with a cold in its head." Cutaneous lesions appear about the nates, fissures about the lips (rhagades), the hair of the head or eyebrows may fall out, and there is almost always an enlargement of the spleen. The child with congenital syphilis, if it lives, presents a prematurely aged appearance, and at puberty the symptoms of syphilis may reappear. When the permanent teeth appear, they are peg-like, with wide interspaces, stunted in length and breadth, and at the cutting-edges, notably the incisors, they are notched and the dentin is exposed. The corneæ present a ground-glass appearance, due to interstitial keratitis. The appearance of a young man of twenty shows no better development than that of a youth of ten, a condition which is called *infantilism.* The forehead is prominent, with a symmetrical skull, and the bridge of the nose is depressed and the tip retroussé. In the presence of the foregoing signs the duty of the physician is obvious—antisyphilitic treatment. In case of doubt apply the *Justus test,* but in no instance should the patient fail to receive the benefit of doubt, for an antisyphilitic treatment, judiciously employed, is an absolutely harmless procedure. Doubt signifies that there should be an utter disregard of indications and contraindications. Thus, mercury and the iodids are regarded as especially harmful in *tuberculosis,* yet for years I have never hesitated to use these drugs to saturation in phthisical subjects with a history of syphilis in whom anomalous signs obtruded themselves, notably cough and paroxysms of dyspnea which were out of proportion to the pulmonary lesion.

A conventional procedure like the foregoing may be heterodoxic, but it has taught me the valuable lesson that one can neither affirm nor deny *lung syphilis* unless one has applied the therapeutic test. There is no doubt that many luetic lesions in the lung and elsewhere merely invite tuberculous invasion. In my earlier years of practice I humbly pursued all the indications and contraindications recommended for the use of drugs until habit was about to extinguish every vestige of judgment I ever had. Indications for the use of drugs are as notoriously uncertain as definitions. One recalls the definition of a lobster as a red fish that walks backward. Another, commenting on this definition, said that the lobster was not a fish, it was not red, and it did not walk backward, but, in all other respects, the definition was quite correct. So it is with many drugs. There is no danger of trying them in small doses if one is prepared to recognize their untoward effects. Now, what are we to do with the therapeutic test in the presence of a syphilitic lesion, and how are we to use it? We are told that mercury is indicated in the primary and secondary periods and the iodids in the tertiary period of syphilis. This is, in a measure, true when the disease is recognized in the primary stage and a regular course of treatment is followed. The old division of syphilis by Ricord into three stages has outlived its usefulness if in the evolution of the disease the stages indicate the progressive malignancy of the disease. The disease may prove more formidable in its primary than in its tertiary stage, and if the tertiary stage means involvement of vital and deeper structures, then the tertiary is frequently the secondary stage. To apply the therapeutic test we must first use mercury, and not remain satisfied that we have used it until we have succeeded in demonstrating the early manifestations of its toxic action. Then we follow with potassium iodid. To give them in combination, the so-called ***mixed treatment***, we are practically using one drug together with its antidote. We know that in chronic poisoning by mercury or lead the iodids cause the latter to be reabsorbed from the tissues into the blood in soluble form and hasten their elimination. This elimination process of mercury may be indicated later on by those who believe that mercury deposited in the tissues may lead to further trouble, but it is certainly not indicated when the object to be attained is the immediate absorption of inflammatory or hyperplastic products. If the iodids are given, use them boldly, especially in the presence of grave organic disease, and the administration of from 2 to 6 drams a day is not infrequent in divided doses with frequent draughts of water. The symptoms and prophylaxis of iodism have been discussed elsewhere (*q. v.*). The statement that syphilitics are immune to the toxic action (iodism) of the iodids can easily be disproved by syphilologists, therefore a tolerance of iodin cannot be used as a proof of the existence of syphilis. In applying the therapeutic test, one must remember that mercury is necessary in all stages of syphilis, and that any result subsequent to the employment of iodid of potassium alone is no criterion.

In *actinomycosis* the iodids in large doses have proved curative in a number of instances, and while the real test of the disease is the presence in the pus of actinomyces, the iodids may be used for diagnostic purposes in pulmonary actinomycosis, which resembles tuberculosis and fetid bronchitis, and in cutaneous actinomycosis where suppurating tumors exist with open sores. Potassium iodid in large doses has also a specific action in *blastomycosis.* In cutaneous blastomycosis iodid of potassium must be given in doses of from 200 to 500 grains a day. It must also be remarked that the verrucous lesions of tuberculosis are not benefited by the iodids, whereas like lesions of syphilis respond more quickly than those of blastomycosis.

In *asthma,* used in the interparoxysmal period, the iodids are especially efficacious. How they act, and what particular variety of asthma is influenced, we do not know. The advertised asthmatic remedies of charlatans consist essentially of the iodids. I have detected the latter in the majority of such preparations. We give the iodids empirically, but to give them consistently, weeks and even months must elapse before good results are obtained. Results have not been achieved in many instances because the practitioner expects immediate results. One must commence with small doses until tolerance is established, and not infrequently I have noted that in the commencement of treatment the paroxysms were increased in frequency, but they soon yielded to the continued administration of the drug.

Effusions of inflammatory origin may be differentiated from those due to venous engorgement, heart disease, and renal lesions by the administration of a few doses of potassium iodid. If the effusion is dependent, say, on an inflammation of the pleura or peritoneum, it cannot be demonstrated in the fluid; but its presence is easily recognized in non-inflammatory effusions by the following test: Saturate a piece of starched linen with the fluid and add a drop of nitric acid; the latter sets the iodin free and produces a deep violet or blue color (starch iodid), according to the amount of iodin present. The reaction can be made with starch powder or in a test-tube with nitric acid and chloroform only. If the latter is added after the acid sets the iodin free, it dissolves the free iodin and assumes a rose color. Dilute acetic acid is recommended by Rivalta to differentiate *exudates* from *transudates.* With the acid, the former yields a precipitate, whereas the latter does not. Traces of blood do not destroy the test, which is dependent on the precipitation of globulins, the content of which in transudates is too small for precipitation. Janowski has examined the effusion in 122 cases by Rivalta's technic; one or more drops of the effusion are added to 100 c.c. of water containing two drops of glacial acetic acid. As a drop of exudate makes its way down through this fluid it leaves a bluish trail like a puff of cigarette smoke in the water, each drop leaving a separate trail. The fluid remains clear and unaltered when the added drop is that of a transudate. He has found this test delicate and reliable. The value of potassium iodid in the removal by absorption of *hydatid cysts* is determined by its administration in a given case. If aspiration of the sac shows the presence of iodin, then the iodids will prove of value, otherwise the results are said to be negative. The power of *absorption of the gastric mucosa* is determined by giving 1½ grains of potassium iodid in a gelatin capsule, exercising care that the outside of the capsule is free from any traces of the salt. Normally, the first traces of iodin appear in the saliva in about ten minutes or more, if the capsule is swallowed on an empty stomach. The iodin is demonstrated (*vide supra*) by having the patient after ten minutes spit from time to time in a receptacle until the iodin is demonstrated. Not much value can be attached to this test, for even in pathologic conditions the absorption is equally as rapid as in health.

In *pulmonary tuberculosis* potassium iodid will aid diagnosis when in apical lung affections dullness or modified respiration is present without râles. The latter may be produced artificially after several days' administration of the drug. I have frequently used the drug to obtain sputum which was absent in suspected pulmonary tuberculosis. Potassium iodid will, by increasing the bronchial secretions, cause the presence of tubercle bacilli in the sputum, although previously absent. Râles in pulmonary tuberculosis may be present on one day and absent on another day. They are more frequently present in damp than in dry weather, and often present in the morning and absent in the afternoon. Besides potassium iodid, the alkaline mineral waters, tuberculin, and menstruation are factors which produce the râles, whereas they may be inhibited by the use of alcohol to excess, certain drugs (balsams and tars), sweating or diarrhea, and continuous dry weather. The iodids will also intensify the auscultatory phenomena of an old *pleuritis* by increasing the secretions. In other instances pleural friction sounds may be made to disappear after a few days' administration of the drug.

Vasomotor rhinitis, manifested by nasal obstruction and a watery discharge (nasal hydrorrhea) in paroxysms, is rapidly cured by 5-grain doses of potassium iodid. This agent was first recommended by my friend, Dr. C. J. Koenig, of Paris, France.

Leprosy: Lepra bacilli are frequently found in the nasal secretions, and Sticker, who asserts that the primary lesion in this disease is an ulcer in the nasal septum just above the cartilage, found the bacilli in the nasal secretion in 128 out of 153 lepers. Leredde and Pautrier find that when the bacilli are absent in the nasal secretion, they may be demonstrated after the ingestion of potassium iodid on the advent of coryza symptoms.

Dr. Heinrich Stern, of New York, directs my attention to the early occurrence of iodism in *nephritis*, owing to the inefficient excretion of the iodids by the kidneys. He has noted toxic symptoms for the same reason from the internal use of rhubarb. He believes that some of the ingredients of the latter (chrysophanic acid and calcium oxalate) contribute to the toxemia.

Sinus headaches: Affections of the accessory sinuses of the nose are frequently responsible for persistent headaches. Such headaches are usually most severe in the morning and lessen in severity during the course of the day. The evident reason for this is that the nasal openings of these sinuses do not permit of the exit of secretions in the recumbent posture, and, further, that the secretions become inspissated during the night and thus close the openings. The nasal sinuses are most frequently involved after attacks of influenza, although other infections are by no means exempt in the etiology. Very often an examination may show a swollen nasal mucosa or the presence of a crust, and reduction of the former by means of cocain and the removal of the latter will bring relief. I have employed the iodids in diagnosis. One knows that in the norm they produce frontal headache and other symptoms of nasal irritation, but only after several days' use in moderately large doses. In affections of the sinus small doses within a couple of days will accentuate the pains. Hempel[390] directs attention to the potassium iodid treatment employed for years at the polyclinic of Professor

Rosenberg in suppurative conditions of the nasal sinuses. The headaches in such conditions are relieved with magical promptness by the drug, which liquefies the pus and at the same time reduces the congestion of the nasal mucosa, thus permitting free exit of the pus. Von Noorden[366] observes that when the iodids are given to elderly individuals for *arteriosclerosis*, rapid emaciation, tachycardia, and insomnia (pseudo Basedow's disease) may ensue. In such individuals a goiter was present which, under the influence of the iodids, was brought to resorption with pronounced signs of hyperthyroidation. The healthy mucosa of the *bladder* admits of no systemic absorption of intravesical solutions. If a solution of potassium iodid is injected into the bladder, the drug cannot be demonstrated in the saliva unless the mucosa of the bladder is diseased or the mucous epithelium is injured. The foregoing fact has been utilized in the diagnosis of *hematuria*. Thus, if the latter is of vesical origin, an intravesical injection of the potassium iodid solution will demonstrate the presence of the drug in the saliva (page 193).

Iodin.—If the tincture is painted on a skin lesion which is *parasitic*, like pityriasis versicolor or favus, the affected area stains a deep brown color and the area of the patch is distinctly defined. If, on the contrary, the lesion is not parasitic, the tincture produces only the ordinary yellowish-brown color. Behrend suggests the use of *chrysarobin* in differentiating areas of pigmentation from pityriasis versicolor. This drug imparts a darker stain to pityriasis than to normal skin. It is well known that chrysophanic acid or chrysarobin, when used as a salve on any part of the face or body, may cause a conjunctivitis. The stains of chrysarobin can be removed by a weak solution of potash, benzol, or chlorinated lime. When chrysarobin is effective in *psoriasis*, the psoriatic area previously deprived of its scales shows a normal aspect which is in conspicuous contrast with the brownish-black discoloration of the stained skin at the periphery. An effective application is that suggested by Fox, and consists of the following:

Chrysarobin Salicylic acid, of each	10 parts.
Sulphuric ether	15 "
Flexible collodion,	100 "

Very often the lesions disappear when kept covered with unmedicated collodion or traumaticin. Impending *mercurial intoxication* is determined by Severino[42] with fresh iodin tincture. With some of the latter on a brush the teeth are touched, and the patient immediately wets the teeth with his saliva. The teeth turn pink in case of intolerance or saturation, but no color change is noted when mercurial treatment is well tolerated. The mercury eliminated in the saliva combines with the iodin to form the red bi-iodid if the proportion in the saliva is excessive. There is only a small amount of mercury eliminated in the saliva when the kidneys and other emunctories are functionating properly, hence in such a condition the test is negative, and is positive only when the mercury, in consequence of improper elimination, accumulates in the system. I use floss-silk between the gums as a sign for determining impending intoxication. A gingivitis first involves the interdental gum, and the use of the silk readily detects any abnormal sensitiveness. Dentists employ tincture of iodin to detect *bacterial masses* on the surface of the teeth. Iodin will produce when applied to a tooth only a faint yellow color, but if bacteria are present, the stain is brownish. These bacterial masses are undetected with the naked eye, hence when iodin brings them to view, the dentist uses some antiseptic (peroxid of hydrogen) in addition to a powder for their removal.

In *dental caries*, potassium sulphocyanate, on which the germicidal action of the saliva is dependent, is diminished, and the use of ferrocyanid of potash internally gives excellent results. The presence of potassium sulphocyanate is detected by a dark-brown color, which results from mixing 2 c.c of saliva with the same quantity of distilled water and adding 5 minims of iron perchlorid.

Ethyl iodid contains four-fifths of its weight of iodin, has a penetrating odor, and is soluble 1 : 400 of water. It is miscible with alcohol. General iodinization is said to be produced by painting it between the shoulders and covering by impermeable dressing. Inhaled, iodin can be detected in the urine in ten minutes, and as long as thirty hours after.

Iodoform.—Sahli[36] employs glutoid capsules for testing the *pancreatic function.* The capsules are made from gelatin hardened with formaldehyd, and are not soluble in the gastric juice. One and one-fourth grains of iodoform are inclosed in a capsule, and in the norm the iodin reaction is obtained in the saliva in from fifteen to seventy-five minutes. The capsule is best swallowed for test purposes in the morning or on an empty stomach. The reaction may be delayed in gastric motor insufficiency, and for that reason it is best to limit our conclusion only to intestinal absorption and the action of the pancreatic juice. In marked intestinal indigestion the salivary iodin reaction is absent or delayed. In affections of the pancreas, notably carcinoma, if the duct is obstructed, there is no reaction. Bramwell[23] reports a case of *pancreatic infantilism* where the patient took a glutoid iodoform capsule; no iodin reaction occurred in the saliva and the capsule was found later in the stools undigested. In a second experiment the same patient took a capsule, and one hour afterward a dose of pancreatic extract, and in two hours the iodin could be demonstrated in the saliva. Iodoform is one of the most efficient drugs in the treatment of local tuberculosis, and its *antituberculous power* is augmented if it is injected in the form of an emulsion and the air excluded. It has been demonstrated that this drug has little influence on a free surface exposed to the air, but when oxygen is excluded, it becomes powerfully germicidal.

Iodipin.—This drug passes through the stomach unaltered and is only dissociated in the intestines, where the iodin is absorbed. Winkler and Stein[24] determine the motility of the stomach by giving a capsule containing 1 gram in the morning in connection with a test-breakfast, and then examination for iodin in the saliva is made in the usual way (*vide* potassium iodid). Freshly prepared starch paper, dipped in the dark in a 5 per cent. ammonium persulphate solution, will turn blue when moistened with saliva containing traces of iodin, the color deepening with any increase of the latter. In normal digestion iodin appears after about fifty minutes; in stenosis or closure of the pylorus, or with diminished or absent bile secretion in the duodenum, the time is delayed. The appearance of iodin is hastened in the saliva in failure of hydrochloric acid digestion (*achylia gastrica*). Iodipin has recently come into general use, and is used subcutaneously to avoid iodism. It remains in the tissues for quite a time after injection, and gives a shadow when exposed to the x-rays, a fact that may interfere with diagnosis unless recalled. The fluid in *chylous ascites* may consist of either chyle or fat, and if iodipin is found in the punctured fluid, it signifies the chylous form of ascites.

Mercury.—If the iodids and mercury are the only specifics in syphilis, then mercury is the more important of the two. Mercury is indicated in all stages of syphilis. All authorities agree on this point, but disagree on the method of administering it. We are here concerned only with the use of the drug in diagnostic therapeutics, and while it may be given by the mouth, by inunction, by fumigation, by hypodermic injection, or by the rectum, I can only be guided by my personal experience, which only recognizes its introduction into the system by inunction. Even here I do not swerve from my custom of using the old-fashioned blue ointment. It may be dirty, troublesome, and uncertain as to dosage, but dosage means nothing with this or any other preparation, or used in any other way, for in all instances we push the mercury until the initial symptoms of intoxication have developed, and they will develop by inunctions more certainly than by most other methods of introduction. There are many new preparations for inunction use, some of which have no odor, others which do not stain, and still others which consume less time in absorption; but when I apply the *therapeutic test*, I am not experimenting, but using a preparation which I know, and grapple it to my soul "with hoops of steel." I use no modification of the conventional inunction treatment. A nurse or masseur does the rubbing, and during the treatment the patient is confined in bed. There is nothing like the warmth of the bed for getting quick results. I recall many patients whom I attempted to mercurialize for severe affections of the eye or nervous system by injections and inunctions in an ambulatory way without result; and the same patients in a few days developed the mouth symptoms of mercury while receiving inunctions in bed.. (*Vide* prophylaxis of ptyalism.) After a course of mercurial inunctions, the duration of which can only be gaged by the advent of mild ptyalism, treatment with the iodids is commenced. The emergency frequently arises where secrecy is necessary. In an event like this I use the *calomelol* ointment, which is highly recommended by Professor Neisser.[121] It consists of calomel in a soluble form with 2 per cent. of free metallic mercury. It does not discolor the skin nor soil the underclothing. It is easily rubbed into the skin (ten to fifteen minutes), leaving a barely perceptible white deposit. A single inunction is 90 grains, and about 30 of such inunctions constitute an ordinary course of treatment. The thighs are convenient when the patient makes the inunctions. To secure quick results from mercury, some writers employ calomel in doses of 3 grains every three hours until a metallic taste is experienced in the mouth. Suppositories of blue ointment were used many years ago by Professor S. D. Gross, who taught that this was the most expeditious way of inducing ptyalism.

Fournier has shown, by the following statistics, based on a study of 1703 cases, that the tertiary symptoms of syphilis develop in proportion to the insufficiency of mercurial treatment:

Treatment of short duration (less than a year)	Tertiary	symptoms	in	1162	cases.
Treatment lasting one to two years..............	"	"	"	265	"
Treatment prolonged..........................	"	"	"	53	"
Treatment extending beyond three years.........	"	"	"	6	"

Therapeutic Test.—One must not necessarily conclude, because an affection yields to mercury and iodids, that it is syphilitic. These agents have, like all alteratives, a profound influence on faulty metabolism. Some claim that psoriasis is a late manifestation of syphilis, acquired or congenital, because many intractable cases yield to antisyphilitic treatment. One would perhaps be equally justified in concluding that eczema is often syphilitic because it responds to calomel. Many local lesions of syphilis, such as skin lesions, mucous patches of the mouth and throat, and pigmentations, disappear often more easily under the influence of local treatment with mercury (oleate of mercury or ointment of ammoniated mercury).

Chancres are readily influenced by mercurial treatment, which rapidly diminishes induration and abbreviates the duration of the lesion.

Condylomata of the anus, due to syphilis, rapidly disappear when dusted with calomel.

For the *rapid diagnosis of syphilitic lesions*, notably questionable growths, the method of Scarenzio, which has not found special favor in France, is enthusiastically defended by Julien, who reports marvelous results from his service at Saint-Lazare. The method consists essentially of making a deep injection into the gluteal region of a solution of liquid vaselin containing 10 centigrams of calomel. The solution must be sterile, and all aseptic precautions taken. A simple injection suffices for the diagnosis. The patient rests in bed from thirty-six to forty-eight hours. No unpleasant effects have followed the injections. Why this should be so superior to other methods of hydrargyrotherapy is unknown, but it seems to have a specific action on *syphilitic neoplasms*. One week usually suffices for the diagnosis, and if at the end of that time the neoplasm is unmodified, the injection will in no wise modify the results of the operation, if the latter has been contemplated. Many growths at one time regarded as sarcomatous could have been cured by antisyphilitic treatment (Esmarch).

Mercurial Reaction.—Not infrequently in doubtful cutaneous and mouth lesions of early syphilis there are certain reactions with reference to the latter which may guide us in diagnosis, and such reactions are not unlike those obtained with tuberculin. In the first few days of inunction treatment, if the syphilitic roseola is present, pyrexia may suddenly develop; the eruption spreads and becomes more intensely red. Plaques may suddenly develop on the tongue. Writers have directed attention to a febrile reaction following the use of mercury in syphilis, which they attribute to the bactericidal action of the drug setting free the endotoxins. One must not confound such pyrexia with an increase of the secondary eruption, secondary ulcerations, or accidental causes. Lindenheim,[357] in a study of one hundred and six cases of syphilis, was only able to attribute the fever directly to the mercury in twelve cases. The mercurial pyrexia always occurs during the first twenty-four hours following the use of mercury, lasting from one to several days, and terminates without interruption of the treatment. From the small number of cases observed, the author does not feel justified in formulating any diagnostic conclusions. In late syphilis many cases have been reported of an intermittent type of temperature suggesting malaria, for which potassium iodid is practically a specific with immediate results.

Justus' Test.—This may be applied to determine whether a given subject is or is not syphilitic. It is based on the following facts: mercury destroys the hemoglobin of the blood, which in the non-syphilitic is rapidly replaced. In the syphilitic, however, the hemoglobin percentage is already reduced, and is still further reduced by mercury; hence, while the non-syphilitic may replace the reduced blood-pigment at once, the syphilitic organism cannot do so. It has been found that after the first injection or inunction of mercury in a syphilitic, there is a distinct fall of from 10 to 20 per cent. of hemoglobin. If treatment is continued, the percentage of the latter increases to normal, and remains at normal as long as treatment is maintained. The fall of hemoglobin-percentage in the Justus test is from 10 to 20 per cent. in from three hours to one day. If it is at all reliable, it is only in the early and more active stages of the disease. The test has been utilized in a good many cases in the Military Hospital at Curragh Camp, and the results show that it is extremely misleading. Even if one could not exclude syphilis by finding Justus' test negative, it might have been hoped that the occurrence of a positive Justus' test was an indication of syphilis. The test, however, seems to be unreliable both when positive and when negative; that is to say, the patient may give a positive Justus' reaction, and yet develop no indication of syphilis at all; or he may give a negative test and then develop ordinary secondary syphilis a few weeks later. The following are the results obtained at Curragh Camp:

Twenty-two suspected cases of syphilis were tested altogether; of these, nine gave positive Justus' test, and thirteen did not. Of the nine who gave the test, and who, therefore, ought to have had primary syphilis, only one developed secondaries, the other eight remaining quite well three months later. Of the thirteen who did not give the test, eight developed secondary syphilis, and five remained well, three months later.

In all these cases there was a sore of some kind, so that the net result is that persons with chancroid are even more liable than those with true chancre to give a positive Justus' test, and the test may be negative with either. One batch of patients had the mercury by inunction, the other by injection. It cannot be argued that the mercurial injection or inunction, as the case may be, prevented secondary symptoms appearing in spite of the original sore being a true chancre and not a chancroid; or, at least, even if it is so argued, the result is similar, for nine of the twenty-two cases did develop secondary symptoms, and only in one of these was Justus' test positive.

Erb's syphilitic spinal paralysis is characterized by spastic paresis, slight sensory disturbances, involvement of the bladder and rectum, and by the fact that improvement is not infrequent. There are, however, many spastic paralyses which are often difficult of differentiation. Marie and Brissaud have observed that in Erb's paralysis the symptoms are very much accentuated after a course of mercurial treatment, and Marie has assured me that a like accentuation attends the use of the iodids alone, but not to the same extent as after the use of mercury.

ANALGESICS.

These agents relieve pain. The most powerful of all is opium. The relief of pain is not merely a palliative measure, but one that affords a material aid in diagnosis, insomuch as many accessory phenomena of pain evanesce when the latter is annihilated. Pain influences all the functions. It produces all grades of shock. Digestion is impaired and nutrition suffers. Nervous symptoms, varying from irritability, depression, and fear, to tremor, spasms, and paralysis, may occur. In a word, pain is a depressant of all the bodily functions, and in such instances opium and its alkaloids may be regarded as relative tonics. It has been shown that if peripheral impressions can be excluded, collapse and shock are practically unknown. Thus, in what is known as physiologic block, when the nerves from a part are thoroughly cocainized, so that no sensation is transmitted, operation upon the part produces practically no shock. The physician dare not ignore the influence of pain in the diagnosis and treatment of disease. Rosenbach, in his recent monograph, recommends morphin in fevers, claiming that it acts favorably by diminishing the excessive irritability of the thermic centers. Certain drugs reduce the temperature. Chloral acts by virtue of the general depression, and morphin by diminishing metabolism and possibly by its specific action on the centers of temperature.

It is always wise to test the patient's *susceptibility to pain* by noting the effect on the pupil while the skin is pinched or when the patient is said to suffer pain. Real painful stimuli cause pupillary dilatation. It is also well to remember that malingering may be suspected if the weight is maintained, insomuch as intense pain disturbs nutrition and consequently diminishes the weight of the body. During a real paroxysm of pain it is usual for the blood-pressure to rise. If, during the examination of a patient, suffering becomes less intense by diverting the attention, it argues for pain of psychic origin. The hypodermic injection of distilled water, if followed by relief, suggests the psychic origin of pain, but there may be in addition to a functional, an organic, cause of the pain. The injection, by eliminating the psychic factor, enables us to justly estimate the severity of the pain.

Opium.—The indications for opium and its derivatives are so numerous that Sydenham observed that few would be callous enough to practice therapeutics without opium. Large doses slow the pulse. Depression followed by sleep usually succeeds its use. Small doses often excite, especially in those who exhibit any idiosyncrasy toward the drug. Opium is a respiratory depressant and diminishes all the secretions except the sweat. It contracts the pupils and produces constipation by arresting the intestinal secretions and inhibiting peristalsis.

Preparations.—Opii pulvis, ½ to 2 gr. Alkaloids of opium: *Morphin* and salts: dose, ⅛ to ½ gr. The salts of morphin are used in preference to the alkaloid on account of their solubility. Prompt analgesic effects are usually secured by means of the salts of morphin used hypodermically.

Dyspnea and not infrequently *cyanosis* are caused by pleural affections and disorders of the intercostal muscles and diaphragm, for, in consequence of the pain, the breathing becomes superficial, and functional dyspnea and not uncommonly cyanosis result. The use of morphin to inhibit the pain will cause dyspnea and cyanosis to disappear. One must not forget that many patients involuntarily employ shallow breathing to prevent coughing, hence analgesics which lessen the tendency to cough will deepen the respiratory movements and thus inhibit dyspnea. It is also evident that when the secretions are abundant, dyspnea may be augmented by the use of analgesics, and bronchial auto-intoxication encouraged.

In doubtful apex lesions in *tuberculosis* auscultation is facilitated by Krönig by giving overnight sufficient morphin or codein to suppress the night-cough and to delay the usual morning clearing of accumulated expectoration until an examination can be made. In doubtful cases I give potassium iodid for three days, and on the evening prior to auscultation in the morning, sufficient codein is given to inhibit the night-cough.

In *pneumonia* dyspnea is the result of pain, toxemia, fever, and loss of function dependent on the consolidation. There is, however, a nervous factor present, for when such patients receive morphin, even though pain is not present, the respirations decrease in frequency and increase in depth. Pain in pneumonia is dependent on pleural involvement, and the patients cannot expectorate for the reason that any effort in coughing causes the most atrocious pain, and in consequence the sputum accumulates and contributes further to the causes of dyspnea and cyanosis. I feel certain that the judicious employment of morphin in croupous pneumonia has given me better service than any other drug. I say judicious employment, for there is a period in many respiratory affections where the cough reflex must be maintained at any cost, for otherwise the patient may be suffocated by his own expectoration.

Dyspnea and cyanosis of cardiac origin likewise often yield to the judicious use of morphin. Many of the unfavorable symptoms of *cardiopaths* can be attributed to fear and pain, and in such instances the action of morphin is marvelous. "The physical is the counterpart of a moral heart," and psychic influences may be objectively demonstrated (*vide* psychic heart reflex).

Many *cardiac neuroses* are associated with murmurs, and the disappearance of the latter after a few doses of opium or codein proves their accidental origin. Many candidates for life insurance are unjustly rejected on account of such accidental murmurs. In a nervous subject one should not draw immediate conclusions respecting the condition of the heart, but should first seek to tranquillize that organ by codein, opium, or even potassium bromid. We ought never to forget that cardiac action is dependent on nervous as well as muscular and hemic influences.

In *laryngeal stenosis* of children Stern advocated the use of opium, which would often relieve the necessity for a tracheotomy. At any rate, by the use of opium one is in a position to exclude the spasmodic element in the disease, although chloroform inhalations would effect the same object more rapidly. Stern concluded that opium inhibited the coughing impulse which conduced to edema and congestion of the air-passages.

One may also exclude the stenotic element due to congestion by inhalation of a spray of cocain and adrenalin. It is, of course, difficult to spray directly into the larynx, but if the physician will spray during inspiration with the curved end of an atomizer directed downward far back into the throat, enough of the spray will reach the larynx. The following formula for this purpose is suggested by Hecht:

Cocain. hydrochlor.		0.12–0.2
Solut. adrenalin. hydrochlor. (1 per cent.)		2.65
Antipyrin		4.0
Glycerin		24.0
Aq. menth. pip.		24.0
Aq. destil.	ad	180.0

The *fright element* is constantly encountered in practice. Thus, when it is difficult to introduce an instrument into the bladder owing to spasm of the vesical sphincter, nothing is so effectual to overcome the latter as a hypodermic injection of morphin.

Acute abdominal pain is often localized with difficulty by the patient and the physician. Palpate the patient almost anywhere, and the pain is often as keenly felt in one as in another situation. In such instances the pain without conspicuous associate symptoms may mean an appendicitis, and for that matter it may just as well be the pain of biliary or renal colic, or if a woman be the subject, disease of the tubes or a pelvic peritonitis. Dr. Henry Wolf, of New York, tells me that in instances like the foregoing a hypodermic injection of morphin often solves the difficulty by causing the pain to disappear from all situations other than at its point of origin. Dr. Wolf recognizes, as we all do, that the use of morphin is not indicated in appendicitis, for the reason that it modifies the symptoms and gives a false sense of security. Morphin for diagnostic purposes, as above indicated, is allowable. To overcome, however, any objection to its use, I would suggest the inhalation of chloroform, not to the point of anesthesia, but just enough of it to quiet the patient without affecting consciousness. The effects of a tranquil nervous system on a disease are witnessed in *diabetes mellitus.* Here opium is one of the most efficient remedies. Diabetics tolerate large doses, and they are essential if results are to be achieved.

Opium is to be used only when the disease cannot be controlled by diet, or in the graver forms in association with diet. *Codein* is preferred to opium because its after-effects are less pronounced and the toxic symptoms of opium rarely occur. Codein is used in ½ grain doses, three times a day, and gradually increased to 4 or 5 grains, three times a day. Thus it is that opium may be used for diagnostic purposes in diabetes and other diseases, to afford us an opportunity of determining how far nervous influences are responsible for symptoms. We cannot put all patients under a conventional rest cure to determine this fact, hence the treatment indicated may be regarded as a *drug rest-cure.*

ANESTHETICS (GENERAL).

Chloroform is selected as a paradigm of the general anesthetics to be used in diagnosis. In the first stage of chloroform anesthesia the nervous system is stimulated. The mind and senses are temporarily exalted, but are soon dulled. Depression of the nervous system occurs in the following order: (1) Brain; (2) sensation; (3) motion; (4) nerve-centers in the medulla. Second stage: Exaltation of the muscular centers, expressed by spasms and struggling movements. Third stage: Loss of consciousness, abolition of sensation and the reflexes. With deepening anesthesia, the automatic and reflex excitability of the medulla and cord is diminished and muscular tone is lost. In this stage operations are usually performed, because anesthesia is complete.

Chloroform.—Circumscribed or tonic *spasm* of a single muscle is not an infrequent phenomenon, but I have often seen a tonic spasm confined to a part of a single muscle. Thus, I recall a circumscribed spasm of the upper third of the right sternomastoid muscle which was mistaken for a tumor, and the patient was ready to submit to an operation, but the supposed tumor was soon dispersed by a few applications of the faradic current. In another instance the supposed tumor occupied the same position in the muscle, and the skin over it was so very much reddened, due to external applications, that the diagnosis of lymphadenitis had been made. It was likewise dispersed by the same current. In another patient the spasm was limited to the appendicular region (*vide* diagnostic psychrotherapeutics). However, all muscular spasms are not so easily dispersed. Take the ***phantom tumors***, for example, which may be caused by a contraction of the abdominal muscles or meteorism. When such tumors are myogenic, they are usually limited to the upper abdominal region, and may involve many muscles, a single muscle, or a part of a muscle. If the tumors are caused by a circumscribed gaseous distention of the intestines, they usually occupy the lower abdominal region, and have given rise to the suspicion of pregnancy (pseudocyesis). As a rule, intestinal gas plus muscular spasm are concerned in pseudo-tumors of the abdomen, and the subjects are usually hysterical women. Diagnosis is not always easy, for they do not always disappear in a hot bath, and chloroform anesthesia may be necessary. Vanishing abdominal tumors in emaciated subjects bear no relation to phantom tumors, but are caused by prolapsed organs, a thickened abdominal aorta, or hypertrophied abdominal muscles. The latter are superficial, horizontal, located to one side of the median line, and are not globular. Mitchell reported a phantom tumor in the left pectoral region. In the presence of pain or contraction of the muscles ***abdominal palpation*** can only be accomplished successfully by means of an anesthetic. A warm bath has also given me good results. Dr. C. E. Cooper advocated the posture shown in Fig. 21. In the posture suggested by Cooper, palpation is greatly facilitated. This posture is also very effective for eliciting the knee-jerk when difficult of demonstration. Adjuncts in the technic of abdominal palpation are: a warm room, the use of warm hands, palpation with the pulps and not the tips of the fingers, circular movements, diverting the attention of the patient by making him take deep breaths, or, as I have found better, counting aloud, examination in different positions (even the knee-elbow posture), and finally combined palpation of the rectum or vagina and the abdominal wall. In palpating the abdomen, it is my custom to palpate in the direction of the fibers of the rectus abdominis and not at right angles to them, as is the conventional method. In this way, the contractions of the muscle in question are prevented and mistakes avoided.

Hysteria is regarded by Oppenheim[37] as a psychosis which does not express itself by disorders of the intellect, but by defects in character and emotional disturbances which are concealed by an unlimited and varied number of physical morbid symptoms. Op-

PLATE II.

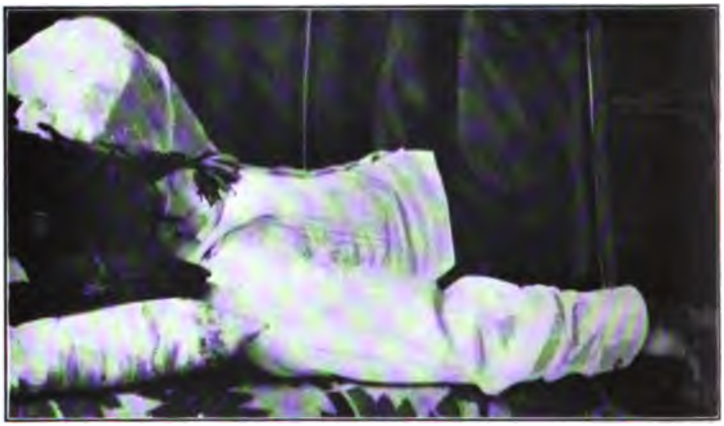

Fig. 21.—Position of the patient for executing palpation of the abdomen. Relaxation of the musculature of the abdomen is attained by allowing the legs to rest on a chair. The latter, if necessary, may be placed on the bed.

penheim says that hysteric symptoms are made conspicuous by the fact that they depend and react to psychic influence. The strange manifestations of the disease led Dujardin-Beaumetz to observe that "impossible" must be erased from the pathology of hysteria. Among the hysterical manifestations are convulsive attacks, contractures, and paralyses.

Convulsive hysteria without an audience is a drama of short duration. The physician who has treated previous attacks or who knows the nature of the attack leaves the patient alone or watches unobserved, and the attacks soon cease. Hare controls the attacks by compressing the nose and mouth to prevent breathing. The patient will then make efforts to relieve herself, and the deep inspiration following relaxes the spasms and brings the convulsion to an end. Compression of a sensitive skin area (hysterogenic zone), especially over the ovary, will also control many attacks. Chloroform inhalation will bring severe convulsions under control, but in this regard it is of no diagnostic value.

Contractures may involve any group of voluntary muscles, and may be hemiplegic, paraplegic, or monoplegic in type. They may last for years or disappear suddenly. The contractures may be confounded with spinal lesions, notably lateral sclerosis, for, like the latter, there may be a spastic gait and exaggerated reflexes. The contractures may be limited to the arm, hip, shoulder, neck, jaws (hysterical trismus), or the tongue. It is currently taught that chloroform anesthesia, by causing the disappearance of the contractures, proclaims their hysterical character. Such anesthesia causes all contractures to yield, whether of functional or organic genesis, hence chloroform is of no value in differential diagnosis. All that anesthesia will do is to assist us in distinguishing between contractures and retractions of muscles (*vide* Esmarch's bandage).

Hysterical paralyses may be hemiplegic, paraplegic, or monoplegic; in fact, hysteria may stimulate any type of organic paralysis. Paraplegia is more common than hemiplegia, and the latter, according to Mitchell, is four times more frequent on the left than on the right side. The loss of power is not usually complete. Thus, the legs may be moved, but are unable to support the patient. Even in the absence of hysterical stigmata we should always suspect a hysterical paralysis if the electric reactions are normal and the muscles do not waste. Wasting can only be determined accurately by measurement, using the unaffected extremity for comparison. To diagnose hysterical paralysis by aid of chloroform it is unnecessary to carry anesthesia beyond the second stage. Movements of the extremities will guide us in ascertaining the true nature of the paralysis. In testing sensibility and many other hysterical phenomena, and for suggestive treatment, I have often had recourse to *partial narcosis;* the patient receiving a previous injection of morphin requires very little chloroform, and during narcosis responds to some questions put forcibly to him and obeys some commands. In intractable cases *hypnosis* may be induced by having the patient inhale a few drops of chloroform, and during the inhalation suggesting to the subject all the phenomena incident to narcosis. The nature of an *ankylosis*, whether true or false, may be determined by deep narcosis. If the limb feels solid when manipulated, and no pain or muscular spasm around the joint is provoked, and there is no joint movement, it is unquestionably a case of true ankylosis. Even a little movement, with muscular spasm and pain, suggests a false ankylosis. Care must be exercised in subjecting a joint inflammation to manipulation under anesthesia until it has been demonstrated that there is no muscular fixation. The latter is a protection to the joint, and if it is released during narcosis, much injury may be done. Janet observes that chloroform anesthesia in the period of excitation does away with all the *stigmata of hysteria*, including the anesthesia and contractures. Under the influence of morphin, it often happens that the anesthesia diminishes and the visual field widens. In *hysterical aphonia* an anesthetic may be given, notably a rapid one (ethyl bromid), and during partial anesthesia one suggests to the patient to shout out loudly his name (Arslan). This method has been successful in a number of cases, and it appears to be equally valuable in the diagnosis of many other symptomatic conditions of hysterical origin.

Pertussis: Rothschild and Brunier have noted the interesting and curious fact that when chloroform was administered by inhalation to children suffering from whooping-cough, the symptoms disappeared at once after a simple inhalation, and in others not until the end of the first or second week. The chloroform was given until complete muscular relaxation was obtained, but without loss of the corneal reflex, and the narcosis was maintained for five to ten minutes. No unpleasant sequelæ occurred. Such a result cannot be due to the antispasmodic action of the chloroform, but rather to its antiseptic effects on the supposititious organisms of this affection. This observation suggests the use of chloroform anesthesia in many other infectious diseases, with the hope that many of them may be similarly influenced, and thus conclusions may be formulated which may prove valuable in diagnosis and treatment. It is evident that disease is not wholly a question of microbic invasion, and that the protoplasmic reaction must be taken into consideration. Thus, the anthrax germs do not proliferate in a frog; yet if the frog has been previously placed in an incubator, the heat will so reduce the cell resistance that the animal becomes susceptible to anthrax inoculation.

Lehman's sign prognosticates a ready or difficult anesthesia in the administration of chloroform. If the eyelids closed by the anesthetizer reopen at once, wholly or in part, the anesthesia will be difficult. The eyes remain closed from the beginning in those who take chloroform well.

Ether.—Wagner[91] reports the case of a man who feigned insanity for two years to escape execution for murder. Ether anesthesia was employed as a *dernier ressort.* It was given three times, and on the third occasion, only when complete unconsciousness and relaxation were attained, was the malingering detected. The man confessed and was finally executed. In obscure cases of *rheumatoid arthritis* without apparent infection Marshall[384] notes the following reaction after ether anesthesia in the usual manner from a cone for fifteen minutes: complete subsidence of pain, restored motion in the involved joints, and partial disappearance of periarticular swellings. Amelioration may not occur for twenty-four hours, and the relief between anesthesia and the return of pain is from two days to two weeks. Acute show more decided changes than chronic cases. If the patient is made worse by the anesthesia, the arthritis is probably of infectious origin. The therapeutic value of repeated anesthesias was not determined owing to the insufficient number of cases. Marshall cites the property of ether utilized by gardeners in forcing the growth of plants which are exposed to the vapor of ether in a closed box, and believes that this stimulating property is exerted on arthritic patients.

Gastric activity may also be tested by the method of Meunier: swallowing a capsule containing ether, the former being tied with catgut in a square of thin rubber. As soon as the catgut is digested, the bag opens, the capsule dissolves, and the ether escapes, causing eructations with the odor of ether. The activity of the gastric secretion is in inverse proportion to the length of time necessary for the digestion of the catgut.

ANESTHETICS (LOCAL).

Cocain is the most conspicuous example of local anesthetics. In full doses it augments arterial pressure and increases the pulse-rate. An excessive dose provokes a contrary condition. It is a cerebral excitant and produces mental exhilaration. It stimulates respiration and the motor apparatus. Applied to a mucous membrane or injected under the skin, it produces anesthesia and ischemia by virtue of its powerful vasoconstrictor action. Congestion follows the ischemia. Instilled into the eye, it produces anesthesia and dilatation of the pupil.

In recent years so many new local anesthetics have been introduced that a comparative summary of them is necessary. In determining the diagnostic value of local anesthesia the discussion will be limited as far as possible to the use of cocain, for despite the introduction of many new local anesthetics, cocain still occupies the first place. The salts of cocain are not soluble in fats, hence for use in oleaginous solutions and anesthetic salves only the alkaloid cocain should be used. Solutions of cocain are not durable and should be freshly prepared in all operations. In general, cocain solutions should be used in the following percentages: Eye, 1 to 5 per cent.; painting mucous membranes, 5 to 10 per cent. The toxic effects of cocain diminish from the nose downward until the larynx is reached, where solutions of 20 per cent. may be used when necessary. In acute *cocain intoxication* use inhalations of amyl nitrite, put patient in horizontal posture with head low down, inject caffein or ether, practise vigorous friction of the skin and artificial respiration (*vide* drugs in the etiology of disease). When cocain intoxication is anticipated, keep the patient in the recumbent posture if possible during all the time the local application of cocain is being used and some time thereafter.

COMPARATIVE TABLE OF LOCAL ANESTHETICS.—(*Modified after Lüders.*)

DRUG.	DURABILITY OF THE SOLUTIONS.	TOXICITY.	UNTOWARD EFFECTS.	DEGREE OF TISSUE PENETRATION.	RAPIDITY OF ANESTHESIA.	DURATION OF ANESTHESIA AFTER AN HOUR WITH 1% SOLUTION.	PERCENTAGE NECESSARY IN OPERATION ON THE NOSE, THROAT, AND EAR.	EYE.
Acoin.......	Durable.	Practically non-toxic.	Slight irritation of the mucosa.	Slight.	Two to five minutes.	One hour.	..	1%
Anesthesin...	Durable.	Practically non-toxic.	None reported.	Acts only on exposed nerve-endings.	Ten minutes.	Hours and days.	10 to 20% mixed with amylum.	..
A-Eucain....	Durable.	Toxic.	Very irritating and is rarely used.	..	..	..	..	..
B-Eucain....	May be sterilized by boiling without losing in efficacy.	One-fourth as toxic as cocain.	Irritating to mucous membranes.	Slight.	Two minutes.	Twenty minutes.	5 to 10%	1 to 2%
Cocain......	Not durable.	Toxic.	Slight.	Strong.	Immediately.	One-fourth to one and one-fourth hours.	5 to 20%	1%
Holocain	Durable.	Very toxic.	Great irritation of the eye.	Slight.	One-fourth minute.	Ten to twenty minutes.	..	1%
Nirvanin	..	Very toxic.	Collapse and secondary hemorrhage.	Slight. Acts only on exposed nerve-endings.	Nine minutes, and in inflammatory areas, twenty minutes.	Three-fourths to one hour with a 2 per cent. solution.	10%	..
Stovain......	Durable.	Slightly toxic.	Slight.	Slight.	In a few minutes.	Not as long as cocain.	5%	1%
Tropacocain	Durable even after 1½ years.	Three times less toxic. than cocain.	Less than cocain.	Less penetrating than cocain.	One-half minute.	Same as cocain.	..	5%
Yohimbin ...	Not durable.	..	Irritates eye.	Penetrating.	Two minutes.	Ten minutes. Effects slight.	1½ to 2%	2%

Local Anesthesia in Ophthalmology.—In the eye cocain has a triple function: it is an anodyne, a local anesthetic, and a mydriatic. It permits eye examinations to be made which would otherwise be impossible, owing to lacrimation, pain, or photophobia. Painful eye affections and many reflex ocular pains may be temporarily inhibited by cocain. Hare[38] suggests the following solution:

Cocain. hydrochlor.	gr. viij (0.53)
Acid. boric.	gr. vij (0.46)
Aquæ dest.	f℥j (30.0)

Use with a dropper in the eye every half hour until pain is relieved.

A 1 per cent. solution of *holocain hydrochlorate* is now used by oculists in preference to cocain, because it acts more rapidly, is more penetrating, does not dilate the pupil, is non-toxic when used locally, and its solution does not spoil. In pains of presumably *glaucomatous origin*, Javal counsels against the use of cocain, as it seems to hasten the development of a glaucomatous attack previously threatened. Later authorities claim, however, that cocain diminishes intraocular tension, and only rarely has the opposite effect been observed. Combined with atropin, cocain is especially useful for dilating the pupil in *iritis*. The anemia of the iris thus induced subdues inflammation and pain after a few instillations. Koller[39] employs the following for this purpose, which is also efficient in *cyclitis:*

1 per cent. solution of sulphate of atropin	
5 per cent. solution of hydrochlorate of cocain	āā ℥ss.

Directions.—Instil every ten minutes until the pupil is dilated (three or four instillations necessary); then only three times a day.

For the removal of *foreign bodies* one drop of a 4 per cent. solution, and a second drop after a few minutes, are sufficient to anesthetize the cornea. To secure more penetrating effects the instillations are repeated three or four times at intervals of three minutes. For diagnosis by *ophthalmoscopic examination* one or two drops of a 4 per cent. solution of cocain will cause sufficient dilatation of the pupil after twenty minutes, and the effects disappear in an hour. It is useful for this purpose, as it only slightly interferes with accommodation and the response of the pupil to light. Any irregularity in the dilatation of the pupil directs attention to an old *iritis*, and may suggest a previous attack of gout, rheumatism, or syphilis.

Euphthalmin is preferred by many for ophthalmoscopic examination. A few drops of a 4 per cent. solution instilled into the eye causes mydriasis in a few minutes and a maximum dilatation in thirty minutes. Its effects last seven hours. It neither injures the corneal epithelium, as does cocain, nor does it irritate the conjunctiva. Used in the following solution, according to Jackson, the effects are not as persistent:

Euphthalmin	1 part
Cocain hydrochlor.	1 part
Distilled water	100 parts

Nose, Throat, Larynx, and Ear.—The addition of *antipyrin* to a cocain solution will prolong its anesthetic action. If one precedes the use of antipyrin by cocainization, the strength of the antipyrin solution may be as high as 4 per cent. Used in the latter strength with cocain, the smarting sensation of antipyrin will be found to be annoying, hence the latter should not exceed 1 or 2 per cent. when used in combination with cocain. There is less danger of intoxication if the cocain is applied with a brush or cotton applicator instead of with an atomizer, and the percentage can be very much increased. Adrenalin used with cocain diminishes the danger of cocain intoxication.

In examinations of the nose for diagnostic purposes (anterior rhinoscopy) a solution of cocain is often necessary. Coakley suggests the following solution for spraying:

Cocain hydrochlorate	gr. x
Antipyrin	gr. xl
Solution of thymol (alcoholic)	♏ ij
Water	℥j.

Thymol will permanently preserve the solution.

The nose is a very important *reflex center*, and must be examined as a routine measure in determining the etiology of many diseases. The functions of the nose are to admit air, warm, moisten, and cleanse it, and by means of smell stimulate appetite and promote the digestion of food by an augumented output of the digestive fluids. All kinds of reflex disturbances, including headaches, neuralgias, chorea, and even epilepsy, have been attributed to some nasal anomaly, and by treatment of a nasopharyngitis, deflection of the septum, enlarged turbinates, etc., many of such disturbances have been cured. *Headaches* and *neuralgias* of nasal origin may be determined by cocainization of first one and then the other nostril. In trigeminal neuralgia the first or supraorbital branch is the one most often affected, and the most frequent predisposing cause is rhinitis. The mucosa of the frontal sinus is continuous with that lining the nose, and with every acute rhinitis there is a corresponding hyperemia of the mucosa lining the frontal sinus. Each frontal sinus has an outlet or infundibulum into the nasal cavity opening into the middle meatus. The pain in supraorbital neuralgia often becomes accentuated with every swelling of the nasal mucosa, due in part to a corresponding hyperemia of the sinus, in part to the retention of secretions. By painting the nasal mucosa with cocain or adrenalin, the outlet of the sinus becomes unobstructed, and with release of the secretions from the latter situation the pain is relieved. The other sinuses communicating with the nose are: antrum, anterior and posterior ethmoidal cells, and sphenoidal sinus. If the nasal mucosa is thoroughly anesthetized for a sufficiently long time, many nasal neuroses may be temporarily inhibited. *Nasal headaches* are, according to Sluder, often caused by secondary involvement of the spheno-palatine ganglion in nasal inflammation. Anesthetizing the ganglion with a pledget of cotton moistened with one drop of a 20 per cent. cocain solution and applied by an applicator just posteriorly to the posterior tip of the middle turbinate will often bring about immediate relief. A 2 per cent. solution of silver nitrate or 0.5 per cent. of formaldehyd applied to the same region will also relieve or cure. A nasal obstruction of some kind leads to *mouth-breathing*, a very frequent etiologic factor in anemia and pulmonary diseases so common in children. (*Vide* nasal patency, in chapter on diagnosis of visceral sufficiency.) The physician should never forget that many *adventitious sounds* are communicated from the nose, thus leading to errors in auscultation of the lungs. Here the use of cocain to the nasal mucosa will eliminate nasal obstruction as a factor in the auscultatory phenomena.

Asthma is often of nasal origin. Many asthmatic paroxysms are inhibited by saturating pledgets of cotton with a 10 per cent. solution of cocain and then introducing one into each nostril.

We may often determine from which side of the nose the paroxysm is excited. If, for instance, after cocainization of the right nostril the paroxysm persists, and desists only after its application to the left nostril, we are frequently justified in concluding that the attack is provoked by some abnormity of the nostril on the left side. To apply the cocain test thoroughly, I use a spray, as it reaches every part of the nasal mucosa. One may provoke sneezing, cough, dyspnea, or an asthmatic paroxysm by touching different parts of the nasal mucosa with a probe. Such areas cauterized with chromic or glacial acetic acid may prove curative. In individuals who suffer from asthma of presumably nasal genesis, stuffing both nostrils with cotton will frequently precipitate a typic asthmatic paroxysm. Even though the paroxysm is not excited, one hears after the *cotton test* the râles peculiar to asthma. Stuffing first one and then the other nostril, the offending side may be determined. Two factors are evident in this test—psychic and reflex. In the former the impaction of cotton creates the concept of air-hunger, followed by the automatic employment of an altered visceral condition which tends to combat it. The reflex factor is predominant, insomuch as previous cocainization of the nasal mucosa will in most instances inhibit any tendency toward a paroxysm. Another test which the author frequently employs to determine a cough of asthmatic origin is to have the patient inhale the fumes of a lighted sulphur match. Such inhalation will enable one by auscultation to at least detect sibilant and sonorous râles, whereas in other instances a typic asthmatic paroxysm is provoked. There is a secret preparation, known as the Nathan Tucker remedy, which is used for controlling paroxysms of asthma. An old analysis made by Aufrecht showed it to consist of the following: Cocain. mur., 1 per cent.; kal. nitrit., 5 per cent.; glycerin., 35 per cent.; aq. amygdalæ amaræ, 35 per cent.; water, 25 per cent.; and plant extracts (stramonium, 4 per cent.). A more recent analysis by Bertram[40] shows it to consist of an aqueous glycerin solution of natrium nitrite (4 per cent.), atropin sulphate (about 1 per cent.), and a not determined plant extract. Tucker uses a well-constructed nasal atomizer. Bertram suggests the following cheaper substitute for the Tucker remedy:

Atropin. sulphat	0.15	(gr. ij)
Natrii nitrosi	0.6	(gr. ix)
Glycerin	2.0	(gr. xxx)
Aquæ destil	ad 15.0	(℥ss)

M. S.—Atomize for three minutes in each nostril and inspire deeply.

After devoting much study to the action of the Tucker remedy, I find that cocain is essential to secure any results from the foregoing formula; hence, to the latter I add sufficient cocain to make a 3 per cent. solution. It may be necessary to reduce the percentage of atropin, for in several instances atropin poisoning (mild) has followed the use of the spray. According to Einhorn,[354] the nearest approach to the Tucker remedy is the following, which is equally effective:

Cocain nitrite	1.028	per cent.
Atropin nitrite	0.581	" "
Glycerin	32.16	" "
Water	66.23	" "

The first two ingredients are manufactured by a process which Einhorn unfortunately does not describe in detail. The solution in question is used with an oil atomizer.

Nasal polypi resemble an oyster in color, but when inflamed, they have a reddish, granular appearance, and may be indistinguishable from the surrounding tissues. The neighboring soft tissues contract after the nasal use of cocain, but polypi are unaffected. Even before the use of cocain the nasal probe shows that while the nasal mucosa is everywhere sensitive, polypi are insensitive. *Nasal obstruction* caused by hypertrophic mucosa only is temporarily removed by cocain, but when the obstruction is caused by polypi or bony tissue, it is uninfluenced by cocain. Just as cocain or adrenalin will cause retraction of the nasal mucosa and thus relieve symptoms dependent on occluded nares, it may be necessary to reproduce or intensify the symptoms, and for this purpose the following errhine, a little of which used as a snuff will create the phenomena of an acute coryza: one part of veratrin and one hundred parts of starch. *Epilepsy* is symptomatic of excessive stimulation of the higher centers of the cerebrospinal system, and irritation of the nasal mucosa is conceded to be a most frequent cause. Here the nasal mucosa may be probed and cocainized as a means of eliciting the existence of reflexes from the Schneiderian membrane. After having located the hyperesthetic areas in the nose in epilepsy as well as in asthma of nasal genesis, one may profitably recall the observations of Killian, that there are the following susceptible areas of the nasal mucosa: (1) The anterior portion of the septum; (2) the anterior end of the inferior turbinate; (3) the lateral wall of the nose slightly above the region of the anterior end of the middle turbinate; and (4) upper part of septum about the tubercle. All these areas may be cauterized at one sitting with trichloracetic acid after preliminary cocainization.

In the mouth one uses the pure alkaloid of cocain, because it is only slightly soluble in water and is not washed away by the saliva. In *odontalgia* the pain is inhibited by the use of the alkaloid on cotton inserted into the cavity of the offending tooth and retaining the cotton in place by a plug of cotton saturated in chloroform of mastiche (mastiche 1, chloroform q. s. to 2). In a carious tooth the pain of an inflamed pulp is made worse by changes of temperature or by chemic stimulation with salt or sugar. If the pain is caused by an alveolar abscess, the tooth is tender on pressure and feels raised above the other teeth when the patient closes the jaw.

In the throat cocain may be variously employed for diagnostic purposes. To reduce *irritability of the throat* in making posterior rhinoscopy, in laryngologic examinations, or in the introduction of the stomach-tube, cocain is often indispensable. It has been found by French physicians that the irritability of the throat is primarily excited from the root of the tongue, hence the latter region may be advantageously sprayed with the cocain solution. It not infrequently occurs that associated with acute pharyngitis or tonsillitis there is also a rheumatism of the cervical muscles, and it may be difficult to say how much of the dysphagia present may be due to one or the other condition. Spraying the throat with cocain will temporarily inhibit the dysphagia of pharyngitis. *Chloretone* (10 to 20 per cent. solutions in oil), when applied to the throat with a brush, is said to relieve dysphagia for several hours.

In *esophagismus* the passage of the bougie is often aided by covering the tip of the latter with a lubricant containing cocain. When one is in doubt whether a *swelling in the larynx* is dependent on catarrhal hyperemia or infiltration, it suffices to make a local application of cocain. The former tumefaction is abated, while the latter is uninfluenced. To render the vocal cords anesthetic, strong solutions (20 per cent.) of cocain are required and are applied with a brush or cotton.

In *otology* it has been found difficult to completely anesthetize the drum-head, but its sensibility can be diminished by repeated instillations of a warm cocain solution (15 to 20 per cent.). Hechinger employs the following anesthetic for the auditory meatus:

Acid. carbolic. liq.	0.5
Cocain. mur.	
Mentholis	āā 2.0
Spt. vini rec.	10.0

This mixture cân be used for the incision of furuncles, paracentesis of the drum membranes, etc., as the carbolic acid in it injures the epithelium sufficiently to allow the cocain to be absorbed. To facilitate the introduction of the Eustachian catheter and render the maneuver painless, cocain may be used. If a few drops of a 2 to 4 per cent. solution of cocain are blown into the Eustachian tube through a catheter, it will arrest the pain of middle-ear disease and subjective ear noises for several hours.

Rectal and *prostatic pains* and their reflexes may be inhibited by ½-grain cocain suppositories. Rectal and anal affections may cause reflex pains in the legs, and in men a fissure of the anus has been known to induce prostatorrhea, thus simulating a gonorrheal affection (Svehla). Cocain will arrest these reflex pains and will often cure the fissure. In painful ano-rectal diseases, the use of *anusol* (iodo-resorcin-sulphonate of bismuth) suppositories, one at night and one after the morning stool, accomplishes a like anodyne effect with the additional feature of softening impacted fecal masses.

Spasmodic vaginal affections may be relieved by a suppository of cocain.

Uterine reflexes, notably the vomiting of pregnancy, may often be inhibited, according to Swonnikoff, by saturating cotton with a 20 per cent. solution of cocain and pushing it by means of a sound partially into the opening of the cervix uteri, where it remains for three minutes. In seventy-seven patients thus treated the results were good. A 10 per cent. solution on cotton applied to a rigid os uteri in the primary stage of labor often results in rapid dilatation. According to the theory of Fliess, *dysmenorrhea* is often associated with nasal affections. A very simple maneuver will determine such associations, by noting whether the pains are influenced by cocainization (10 to 20 per cent.) of the nasal mucosa. Respecting the theory of nasal dysmenorrhea, many writers attribute the results to suggestion in certain hysterical patients, and note that equally good results may be attained if the cocain is applied to the cervix, rectum, or some other mucous surface. In a still later report Fliess[385] denies suggestion and shows that when the hyperesthetic areas in the nose are irritated with a probe, the pains of dysmenorrhea can be provoked. Koblauck finds that nasal cocainization will temporarily inhibit *labor pains*, and that applications of adrenalin will excite them. Siegmund[386] found in some *masturbators* an exquisitely sensitive point in the nasal mucosa which, when even lightly touched with a probe, causes extreme pain and general nervous symptoms. He also notes that many severe paroxysms of *gastric pain* are really associated with a sensitive nasal area, and this relationship is established if, after cocainizing (20 per cent. solution) the area in question, the pain ceases within fifteen minutes. Cauterization of the hyperesthetic areas is curative in the conditions mentioned. An intimate relation exists between the nose and the genito-urinary organs, and here cocain may be of service in diagnosis. Tickling the nasal mucosa may cause the expulsion of a few drops of urine. *Enuresis nocturna* in children may be caused by nasal obstruction or more often by adenoids.

Acute dilatation of the lungs may be recognized by the cocain test (*vide* page 499).

Anesthetization of the *bladder* is often necessary for diagnostic purposes to determine the origin of reflex pelvic pains and other pelvic symptoms, to aid in cystoscopy, etc. Many remedies to secure anesthesia have been suggested. Cocain (2 per cent.) injected into the empty bladder may give rise to toxic symptoms, hence eucain B, being less toxic, is often preferred. From 10 to 15 c.c. of a 2 per cent. solution is used, although it is less anesthetic. Antipyrin (10 per cent., of which 4 c.c. is injected into the empty bladder, is an excellent anesthetic, and Guyon recommends the following: guaiacol, 5.0; iodoform, 1.0; and sterilized olive oil, 100.0. From 5 to 10 c.c. of the latter is injected into the empty bladder. Anesthesia is complete in one hour and disappears in three-fourths of an hour. To dilate a contracted bladder in tuberculosis of the organ, a bladder-anesthetic (novocain, cocain or alypin) should be first injected into the viscus.

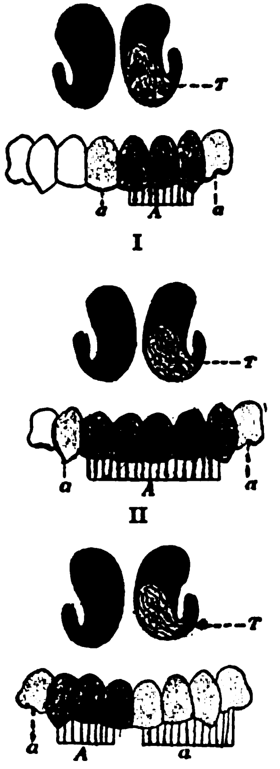

Fig. 22.—*T*, Cocain tampon placed in the left nasal cavity; *A*, teeth completely anesthetized; *a*, teeth incompletely anesthetized. I, Thirty-seven times complete anesthesia, comprising the two incisors and the corresponding canine, was secured on the same side and an incomplete anesthesia of the first bicuspid. II, In eight cases the anesthesia embraced the teeth designated in this figure. III, In one case only was the anesthesia crossed as shown in this illustration.

Urethral irritation may cause many reflex troubles, especially when a stricture is present. These reflexes may merely amount to pains in the perineum, abdomen, or more remote parts, or, as has been suggested, they may be identified with neurasthenia and other nervous affections. Urethral anesthesia may be indicated in establishing a diagnosis, or, at any rate, the latter maneuver is often necessary to facilitate urethral instrumentation. To completely anesthetize the urethra, proceed as follows: First inject a solution of cocain (0.5 to 2 per cent.) with a syringe and cause its retention for several minutes by closing the meatus. Next take a urethral instillation instrument (Guyon's preferred) and deposit the solution drop by drop along the urethra toward the bladder. Socin recommends a 5 per cent. solution, and claims never to have observed any toxic symptoms. Others prefer to take no chances, and use eucain (2 per cent.). We must recall the fact that cocain dries the urethral mucosa, and in consequence offers some hindrance to instrumentation.

Priapism may be controlled by placing cotton under the foreskin at bedtime, and on waking a few drops of a solution of cocain (10 per cent.) are placed on the cotton. Anesthesin or cocain (16 drops of a 1 per cent. solution) may prove of value in the differential diagnosis of *gastric* from other pains. Thus, if this test is followed by relief, say, within fifteen minutes, it is an argument in favor of a gastric, and not a duodenal, ulcer (*vide* orthoform and anesthesin).

Anesthesia of the *teeth* and *gums* below the nasal fossa has been noted by Escat and Lederer[286] to follow a tampon moistened with cocain and inserted in the nose (Fig. 22). The anesthesia does not develop until from fifteen to twenty minutes after the tampon dipped in 5 or 10 per cent. solution of cocain has been introduced into the nose. The anesthesia is most intense about the thirtieth minute; the tampon is then removed, and the anesthesia persists for fifteen minutes longer, and then gradually subsides. In examination of five hundred patients the anesthesia was found crossed in eight cases, and in thirty-seven the gum and teeth on the opposite side were also partially anesthetized. In Lederer's experience the anesthesia amply sufficed for operations on the teeth, and even extraction of carious roots. The foregoing facts are of great importance in diagnosis. Thus, some of the teeth of the upper jaw can be excluded from participation in the etiology of trigeminal neuralgia. One may also note that Treupel has found repeated cocainization of the nasal mucosa of great benefit in cases of trigeminal neuralgia, even when the accessory nasal cavities were apparently sound.

Kast and Meltzer[287] found in animal experimentation that the sense of pain is present in normal organs, and that it is considerably augmented in inflamed organs; and that a subcutaneous or intramuscular injection of cocain is capable of completely abolishing this sensation in normal as well as in inflamed organs. They suggest that the anesthesia of the internal abdominal organs observed by certain surgeons was due to the use of cocain. These observations may prove of great value in the differentiation of *visceral pains* of the abdominal organs from pains of any origin other than visceral.

To induce *skin anesthesia* the pure alkaloid cocain, applied as an ointment, is preferable to the salts. Here when ointments containing a large percentage of the alkaloid are used, the pain of many skin affections (eczema, erysipelas, shingles) is relieved. With an unbroken cuticle it is practically impossible to secure skin anesthesia, all statements to the contrary notwithstanding. I have obtained good results very often by combining salicylic acid or carbolic acid with cocain in the salve. The former is an excellent keratolytic and may be used in strong concentration (10 to 50 per cent.), unless the cutaneous affection is acute, when a salve of not more than 3 per cent. should be employed. Salicylic acid combined with other drugs in a salve will facilitate their penetration into the deeper layers of the skin. To render the skin area anesthetic, the method known as *kataphoresis* is often used successfully. By the latter method the pad of the positive electrode of a galvanic current is saturated with a solution of cocain (5 to 10 per cent.) and applied to the area destined for anesthetization, with the other pole a little distance away. A moderate current is employed and skin sensibility is abolished in ten minutes. Gowers has found the latter method very efficient in relieving the pains of tabes. Morton[282] advocates his high-potential high-frequency electrode (Fig. 23) for the introduction of medicaments into the living tissues by means of high-potential currents. Medicaments thus used may be detected quickly in the patient's saliva, blood, and urine. The following

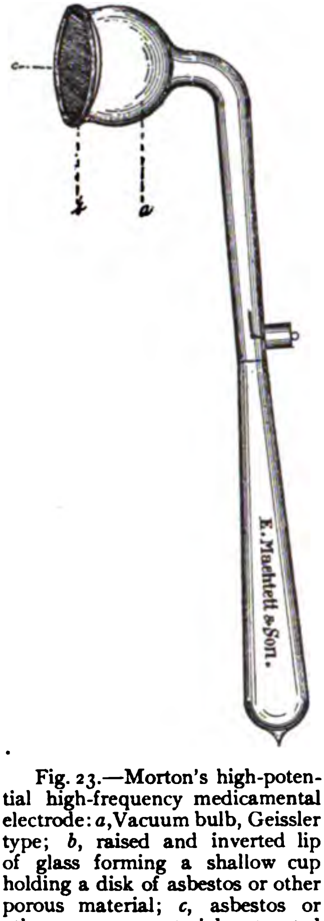

Fig. 23.—Morton's high-potential high-frequency medicamental electrode: *a*, Vacuum bulb, Geissler type; *b*, raised and inverted lip of glass forming a shallow cup holding a disk of asbestos or other porous material; *c*, asbestos or other porous material saturated with medicament desired to be introduced by kataphoresis or serving as a fluorescent disk.

recipe was found extremely useful in the treatment of tuberculous glands and local and general tuberculosis, goiter, etc., by this method:

℞.	Spt. terebinth.	℥ij
	Tinct. iodinæ	℥j
	Creosote	℥ss
S.—	External use.	

This mixture makes a colorless solution. If it causes too much irritation of the skin, it may be diluted with castor oil, olive oil, or liquid albolene. Another useful recipe is:

℞.	Spts. terebinthinæ	℥ij
	Thymol to make saturated solution.	

The same principle of the close application of porous material to the electrode can, of course, be applied to any shape and form of vacuum electrode, and many modifications applicable to different localities to be treated have been used, particularly a tubular electrode, about which the porous material is wrapped. Throat, vaginal, and rectal electrodes are easily constructed. Morton has used such electrodes for producing local anesthesia, employing guaiacol, one dram, cocain muriate, five grains (this solution he has previously used for producing electrococain local anesthesia by the aid of the galvanic current). Also to introduce mercurial salts, potassium iodid, antiseptics, such as salicylates, and thymol in affected joints, and to introduce medicaments for the treatment of lupus, local tuberculosis, and cancer. Injections of cocain into the tissues about or within the nerve-trunk may be useful in diagnosis. Intraneural injections require a 2 per cent., and about the nerve-trunk a 3 per cent., solution of cocain. In both instances sensory and motor paralysis affecting the entire distribution of the nerve occurs in about fifteen minutes, lasting a variable length of time, even for hours after the intraneural injections.* To differentiate *neuralgic pains* of central or peripheral origin, cocain subcutaneously in proximity to the pain may be used: relief suggests the latter origin.

Spinal Anesthesia.—At the Bonn surgical clinic the technic of an intraspinal injection, according to Finkelnburg,[666] is as follows: With the patient in the sitting posture, the needle is introduced exactly in the middle line, between the first and second or the second and third lumbar vertebra. No trocar is used. Several syringefuls of cerebrospinal fluid are removed and the following is injected: 0.04 to 0.06 gram stovain mixed with 0.11 per cent. of sodium chlorid and 0.01 per cent. adrenalin. After the injection the patient is put in the recumbent posture. Unless the injection is made accurately in the middle line, the anesthesia will be unilateral. At the end of a minute, anesthesia may be noted in the scrotum, which spreads to the inner surface of the thighs and the anal region. Then follows weakening or an absolute loss of the knee-jerk, which, if present within one minute, is an absolute indication that the anesthesia will be effective. The Achilles tendon-reflex disappears in the second minute. If the pelvis has been raised, anesthesia extends to the navel. At the end of five minutes analgesia of the legs and body up to the level of fifth and sixth ribs is complete. Analgesia of the scrotum, spermatic cord, and peritoneum is unsatisfactory. Sensation begins to return after forty-five to sixty minutes. Stovain is considered by Fourneau to be as powerfully analgesic as cocain, one-third as toxic, and slightly germicidal. If cocain is used for spinal anesthesia, it is wise not to exceed 0.5 of a grain. Meltzer and Auer[313] have shown that Epsom salts by subarachnoid spinal injection produces in 25 per cent. solution (1 c.c. of this for every 25 pounds of body-weight), after three or four hours, paralysis and analgesia of the legs and pelvic region. After eight to fourteen hours sensation and motion return. Retention of urine may occur, although blood-pressure is uninfluenced. Respiration is slowed, and large doses may arrest respiration. Subcutaneous injections of salts of magnesium induce local anesthesia.

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* One must remember that intraneural injections of a nerve with a motor element may be followed by paralysis of muscles supplied by the nerve.

Diagnosis.—Muscular relaxation is complete after spinal anesthesia, hence the method may be employed in motor spasms, for detecting and breaking up joint adhesions, for relaxing hysterical contractures, and to aid in abdominal palpation.

Extra-pulmonary coughs: Irritation of the trigeminal nasal branches often causes cough. The cough areas are located about the anterior and posterior ends of the inferior turbinated bodies and that part of the septum lying opposite the latter. Application of a sound, even to the normal mucosa, may cause cough. Employ a strong solution of cocain, first in one and then in the other nostril, and note if the cough is influenced; or one may with the probe locate one or more cough areas, and each is cocainized in turn. From the pharynx, a cough may result from acute and chronic diseases of the mucosa of this region or from the chain of lymphoid tissue along the lateral walls of the pharynx (*pharyngitis lateralis hypertrophica*). This mass of lymphoid tissue, being partly hidden by the pillars of the fauces, often escapes attention, unless with a retractor the palatine arch is drawn forward. Here, again, the probe and cocain aid in diagnosis. An elongated uvula is, in my experience, the most frequent cause of extra-pulmonary coughs. Expectoration is often present, owing to associated catarrh. The cough is often associated with nausea and vomiting. The cough is worse in the recumbent posture. Inspection does not always show elongation, because some patients involuntarily contract the palate and uvula. Cocain applied to the uvula alone is of little value in deciding whether this structure is involved: the adjacent structures, from which the cough reflex is excited, must be cocainized. Amputation of the uvula is the only cure, and if followed by a cessation of cough, the diagnosis is made. The insufflation of tannin against an elongated uvula frequently gives instantaneous relief when a cough is dependent on that cause. When it is a question of choosing between uvulotomy and astringent applications, the local use of adrenalin may be tried. If shrinkage of the uvula follows, astringents will prove effective; otherwise uvulotomy is demanded, because the elongation is caused by hypertrophy and not by hyperemia. Similar conclusions may also be formulated in tonsillar enlargements. The lingual tonsil situated at the base of the tongue when hypertrophied often excites a cough. Diagnosis is made with the laryngoscope, showing the structure to be red and swollen, and partially or completely filling the glosso-epiglottic fossa, and sometimes encroaching beyond the free border of the epiglottis. If the lingual tonsil is suspected, we may use the cocain test. I once treated a hysterical woman with complete anesthesia of the fauces, who suffered from esophagismus. Upon introducing the esophageal sound, cough was invariably produced, and could be inhibited by cocainizing the esophagus at its commencement.

Novocain.—The usual substitutes for cocain have not been devoid of irritant action. This agent, according to Prof. Braun, is not only free from irritant action, but is less toxic than cocain (six times) in proportion to its local anesthetic power. It is completely soluble in water and can be boiled without change. A 0.25 per cent. solution suffices completely to anesthetize thick nerve-trunks, such as the sciatic nerve, in about ten minutes. Solutions of 5 and 10 per cent. are used for anesthesia of the mucous membranes. Dose internally, to adults, up to 0.5 gram. In the diagnosis of many painful affections of the lower limbs the sciatic nerve may be excluded from participation in the pain by intraneural injection with an anesthetic.

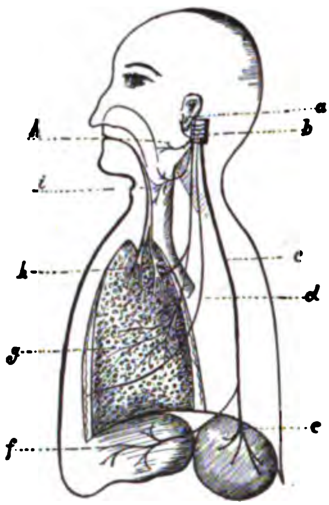

Fig. 24.—Diagram of the afferent nerves which when irritated stimulate the respiratory centers (*b*) and produce coughing. The nerves are distributed—*a*, to the ext. auditory meatus; upper *h*, to the pharynx; *i*, to the larynx; lower *h*, to the bronchi; *g*, to the lung; *d*, to the pleura; *f*, to the liver; *e*, to the spleen and esophagus.

Orthoform (New).—It exercises its anesthetic action on exposed sensory nerve-endings, and the analgesia lasts, on an average, about twenty-four hours, and in some instances several days. The anesthesia begins a few minutes after its application. It is too irritating for sensitive mucous membranes like the eye. Its local use to wounds has been followed by erythema, urticaria, eczema, and even gangrene. The use of the powder rather than a salve is less likely to be followed by the latter accidents. Dose, 5 to 10 grains. The pain of *ulcer of the stomach* is arrested by giving 8 grains of orthoform in one ounce of hot water. After this manner gastric ulcer may be differentiated from gall-stones and many gastric neuroses which are uninfluenced by the drug. In this connection Dr. Fenwick suggests a simple method of detecting a gastric ulcer. He lets the patient swallow a dram of common salt in a tumbler of water when the stomach is empty; the salt coming in contact with an ulcer, like any other raw surface, will excite a lively attack of pain; otherwise no pain results from the ingestion of salt. The same maneuver may be used to determine whether an ulcer has healed after treatment. In applying the salt or orthoform test, have the patient place himself in different postures, notably on his back with the pelvis elevated, for the most frequent situation of an ulcer is the posterior wall of the pyloric portion near the lesser curvature. Gastric ulcer is a common disease; in fact, Ewald claims that 5 per cent. of Germans have ulcer. An ulcer often masquerades as a dyspepsia, and that is the reason why so many dyspeptics remain dyspeptics (*vide* rectal alimentation).

Anesthesin has been suggested as a substitute for orthoform, for it possesses none of the irritating properties of the latter. Dose, 5 to 8 grains several times daily (maximum, 30 grains), taken before meals. In action, anesthesin corresponds to orthoform. Anesthesin has evidently not the same diagnostic value as orthoform in ulcer of the stomach, insomuch as it appears to benefit all forms of gastric hyperesthesia. According to Reiss,[41] all forms of *vomiting* of gastric origin (but not from central causes) are controlled by large doses of anesthesin given in the form of wafers. He does not hesitate to push the dose as far as 120 grains per day.

ANAPHRODISIACS AND APHRODISIACS.

Many neuroses are intimately associated with the sexual life, and it is often difficult to say whether they are the cause or the effect of sexual anomalies. At any rate, by subduing inordinate sexual desire or by stimulating an enervated apparatus many valuable data can be elicited in etiologic diagnosis. One of my patients, an asthmatic, could never indulge in coitus without suffering an asthmatic paroxysm. During the act, his nose would become obstructed. Such attacks ceased when the patient was instructed to use a cocain spray before attempted intercourse. There is a close relation between engorgement of the turbinate tissues and the sexual apparatus. In some women there is engorgement of the nasal erectile tissue at each menstruation, and in others, the tissue swells at each period, even though menstruation is absent. It has even been shown that *menstrual anomalies* depend on intranasal disease, and that the use of cocain in the nose will temporarily inhibit such anomalies and that treatment of the nasal condition will cure them. Epistaxis is frequently an expression of vicarious menstruation. Paresis has been attributed to sexual excess, but there is little reason to credit this statement, for it is more often an early symptom of this disease. Naturally we are unable to limit ourselves to drugs when either object (stimulation or depression of the sexual apparatus) is in view, hence all methods contributory to either purpose must be employed. The *sexual act* signifies an excessive discharge of nerve force, to which individuals react differently. Some, like the neurasthenic, are completely exhausted, and with the latter, depression is associated—*omne animal post coitum triste.* With others, a sedative effect is secured, and all the functions after the act seem to act more harmoniously. *Masturbation* is credited with a host of afflictions, but the effects are essentially mental, developed from the loss of self-respect and the sense of unmanliness. Occasionally onanism is followed by various grades of impotency (usually psychic) and premature ejaculation. In women the sexual life is inseparably connected with the menstrual function. It is at this particular period that mentality is influenced and nervous troubles are created and exaggerated. With the termination of menstruation the woman is ushered into the *menopause,* a period which imposes even greater hardships on the nervous system than the period which she has just survived. One speaks of a masculine menopause when toward the fifth decade, together with diminished virility, the entire character of man is changed, and he becomes discontented, melancholy, and irritable. A satisfactory sign of sexual potency is the *penile reflex:* The patient is in the recumbent posture, with flexed and abducted thighs. Each time the head of the penis at the urethral opening is compressed, the finger of the other hand in the median line at the scrotoperineal junction appreciates a distinct contraction of the muscles. Compression of the penis may be necessary a number of times in succession before the reflex is elicited. The penile reflex is either diminished or absent in impotency. In the "virile reflex" of Hughes, the absence of which is said to indicate either masturbation or some loss of sexual power, the penis is taken and pulled with some little force upward in the direction of the umbilicus; the foreskin is then caught near the frenum and the corpus cavernosum grasped with the second and third fingers; if the corpus cavernosum is now struck with the other hand, a jerk is elicited. The latter, according to my observations, is less evident than the penile reflex.

DRUGS WHICH STIMULATE THE SEXUAL ORGANS.

(APHRODISIACS.)

- Alcohol.
- Camphor.
- Cannabis Indica.
- Cantharis.
- Damiana.
- Glycerinophosphates.
- Phosphorus.
- Spermin.
- Strychnin.
- Tonics.
- Yohimbin.

Aphrodisiacs have been discredited by time and experience, and no better fate has been accorded to spermin and liquor testiculorum (*vide* organotherapy). In most instances diminished virility is naught else but the local expression of some constitutional affection, and to temporarily stimulate the diminished function by drug treatment is an irrational procedure. Local causes unquestionably exist, such as the sequelæ of gonorrhea. Neurasthenia is one of the most frequent causes of impotency, and the latter needs no treatment if the former is corrected. Yet I have seen instances of *psychic impotence* surviving the cure of neurasthenia, and in such instances psychic treatment is necessary for a psychic disease. The medium for such treatment may be drugs. Thus many charlatans employ indifferent suppositories, telling the patient that they influence the sexual tone more directly than by any other method of treatment. The suppository naturally stimulates the sexual function, like any other foreign body in the rectum. I recall a patient who suffered from satyriasis, and who was cured after the removal of a large scybalous mass from the rectum. One of my friends, a physician, suggested that one or two drops of fluidextract of echinacea, when inserted into the urethral orifice, would increase sexual desire, and such is actually so, for it creates a titillation, and the mind does the rest. It is evident that the drug acts only by virtue of the alcohol contained in it, and any other non-irritating extract accomplishes the same object. The foregoing maneuver ought not to be eschewed, for it is the primary attempt at coitus in psychic cases that determines the further performance of the act. If the first attempt is successful, the patient is practically cured. Many of these psychic cases suffer from *premature ejaculation*. A method which I have found effective in the latter condition is to have the patient instil several drops of a 2 or 3 per cent. solution of cocain into the urethral orifice, and if the glans is hyperesthetic, to rub over it a little of the same solution prior to coitus. In most instances ejaculation may be prolonged at will, although the sexual act is usually deprived of all feeling. However, the procedure is an educational one, seeking to make the sexual act conform to the laws of habit and to make the reflex act a perfectly coördinated one. Immersion of the penis and scrotum for several minutes in cold water prior to coitus I have found very efficient in preventing premature ejaculation. A prominent comedian, who was also a physician, told me that he never appeared before an audience without suffering from "stage-fright," and that a large dose of paregoric always gave him the necessary courage. In instances of impotence one is often able to determine their psychic character by giving to the patient a sufficiently large dose of opium previous to intercourse. Potassium bromid, although regarded as an anaphrodisiac, I have frequently employed as an aphrodisiac when fear dominates the sexual act in psychic impotence. One may recall in this connection the theory of Goltz, who ascribes an inhibitory power of the brain which controls the center of erection in the spinal cord, and though the latter may send out impulses for the creation of an erection, it is inhibited by the irritated cerebral center. To my mind, many cases of psychic impotence are attributable to the foregoing mechanism.

Yohimbin, an alkaloid obtained from the cameroon tree, is employed in doses from $\frac{1}{12}$ to $\frac{1}{6}$ of a grain three times a day as an aphrodisiac. It is supposed to possess a specific action by augmenting congestion of the sexual organs. The mass of testimony concerning its efficacy is conflicting—some lauding, others condemning it, as an aphrodisiac. My experience with the drug shows that in some cases it gives excellent results and in others it is perfectly innocuous. It should be given a trial in all cases of impotence, irrespective of cause, for while it is supposed to be especially beneficial in sexual neurasthenia, good results were obtained by me in two tabetics.

DRUGS WHICH DEPRESS THE SEXUAL ORGANS.

(ANAPHRODISIACS.)

Belladonna.
Bromids.
Bromipin.
Camphor.
Cocain.
Conium.
Digitalis.
Gelsemium.
Hyoscyamus.
Lupulin.
Opium.
Stramonium.

Increased sexual desire is likewise an expression of some local or general disturbance, but until the cause is discovered, the anomaly must be subdued. A reliable drug is potassium bromid, which must be pushed to bromidism if necessary. Often augmented sexual function is psychic and must be influenced by psychic treatment. I heard of a patient who suffered from satyriasis, and whose erections were only subdued by the music from a music-box (musicotherapy). The latter was constantly at the side of his bed, and when the erections became painful, the box was put in operation. There is nothing like mental and physical work for the cure of aphrodisia. Work distracts the patient from the lascivious picture which an idle mind creates, and employs nerve force in a legitimate direction.

"Absence of occupation is not rest,
A mind quite vacant is a mind distressed."

ANTICONVULSANTS.

These drugs usually act by reducing the excitability of the motor area in the cerebral cortex. They also act on the motor and sensory columns of the cord by reducing their motor and sensory conductivity. The bromids are the most conspicuous examples of this class of drugs. All the bromids have practically the same action, although the sodium and strontium salts are less depressing and less likely to give rise to gastric irritation. The potassium salt, however, is usually employed.

Potassium Bromid.—Its action on the brain and spinal cord has already been noted. In large doses it depresses the heart and vasomotor center. It is rapidly absorbed and appears in the urine fifteen minutes after its ingestion. Continuous and excessive use leads to *bromism.* In the use of the drug for diagnostic or therapeutic purposes we have attained our temporary object when the palate reflex is lost. The pharyngeal reflex may be diminished or even abolished in the norm, hence this reflex is only of value if tested prior to the administration of the bromids. Another means of determining the degree of impregnation of the system is by means of the pupil. From the moment of bromid administration the pupil demonstrates a tendency to dilate, but it nevertheless reacts, as in the norm, to light and accommodation; later, the mydriasis is accentuated, and the reaction to light and accommodation is tardy; at this phase impregnation is attained. If one persists with the bromids, the period of intoxication is reached, as shown by mydriasis and the loss of the pupillary reflex to light and accommodation.

Preparations.—Potassium Bromid, Ammonium Bromid, Strontium Bromid, and *Lithium Bromid:* Dose, 10 to 60 grains. Strontium bromid is especially efficacious in epilepsy, and it is said to rarely cause depression or cutaneous eruptions.

Bromipin has been introduced as a substitute for bromids in the event the latter are not indicated, owing to their toxic action. The dose is 1 to 3 fldr. It is very unpleasant to take, hence its use by enema or capsules is suggested. It is said to have none of the toxic effects of the bromids. My experience with most of the new, suggested to substitute the old, drugs, owing to the toxic action of the latter is that one is merely employing drugs of less strength, and that by giving smaller doses of the old drugs, you can accomplish the same object. To get the effect of any drug, we must push it to saturation, until the border-line of toxicity and physiologic action is reached.

The bromids are especially indicated in *epilepsy,* in which disease they are practically specific in action. This specific action is noted in about 90 per cent. of the cases of idiopathic epilepsy. Binz presents the following results:

1. Permanent cures, 40 per cent.
2. Total abolition as long as the drug is continued, 12 per cent.
3. Diminished number and violence of the attacks, 83 per cent.
4. No influence, 2½ per cent.
5. Number of attacks increased, 2½ per cent.

To arrest the attacks a large dose (ʒss to ʒiss) is preferably given about five hours before. Children tolerate proportionately larger doses than adults. The bromids often act better in combination, or smaller doses may be required if used in combination with potassium iodid or antipyrin. If the depressing action on the heart is pronounced, a bromid may be given with digitalis in the same prescription, or the latter may be given separately. The old conception of epilepsy, that it is a disease based on defective chemic processes, is being revived. An important step made in treatment is *dechloridation*, *i. e.*, the elimination of alimentary salt in the diet. It is an undoubted fact that the removal of sodium chlorid from the diet diminishes epileptic seizures, and that better results are achieved in the *salt-free treatment* when the bromids are taken. With the salt starvation method of Toulouse we can accomplish better results with half the amount of bromid. When the bromids fail, borax may be used. The diagnosis of epilepsy is not always easy in the forms without convulsions, known as *petit mal*. Here Gowers recognizes at least seventeen manifestations. Such patients may have mere attacks of vertigo or unconsciousness; they may suddenly stop talking, with eyes fixed and face pale; they may perform some unconscious automatic action, such as undressing, expectorating, rubbing of the face or beard, sudden jerking of the limbs, visual disturbances, tremors, etc. One may profitably recall the observation of Gowers, that *vertiginous attacks* are on the border-line of epilepsy and suggestive of this disease. Here the bromids may be used for a diagnostic object. Biborate of soda, first recommended by Sir William Gowers, is also of great value in epilepsy, especially in the variety known as *petit mal*. Borax is given in beginning doses of 5 to 10 grains, three times a day, gradually increased. Its continuous administration may be followed by psoriasis; indeed, some have used borax as a diagnostic drug to determine the existence of psoriasis. It may be interesting to observe that the statistics of Dr. A. Turner show that when idiopathic epilepsy is arrested, such arrest took place in 50 per cent. of the cases *within one year* of the commencement of systematic treatment. It has been suggested by M. Pierret to administer a cerebral excitant in suspected cases of larvated or *latent epilepsy* as an aid in diagnosis.

We know that there are drugs known as cerebral excitants which can in large doses stimulate the motor centers sufficiently to cause epileptiform convulsions. Such drugs are belladonna, cocain, camphor, quinin, salicylic acid, etc. Now, epileptics are more susceptible to the action of the convulsants than are other patients. Pierret gives, then, to a suspected subject therapeutic doses of belladonna or any other convulsant for several days, and in several instances others and himself have noted a true epileptic seizure following. It frequently happens that we are compelled to detect a *false seizure* in a malingerer. It has been observed that true epileptic attacks may be arrested by provoking certain inhibitory reflexes; strong flexion of the big toe, violent pain by pressing on the supraorbital nerve, cauterization of the pharynx, etc. The foregoing facts are unknown to the simulator. It is also known that in true epilepsy, after the termination of the first, a second attack may be induced by inhalations of oxygen.

High blood-pressure is often maintained as a result of augmented tonus of the vasomotor center, and is quite independent of vascular disease. It is essentially a nervous phenomenon. Give such subjects sufficiently large doses of bromids for several days, and it will be noted that there is a considerable fall in the blood-pressure. Too many hasty conclusions have been formulated concerning blood-pressure, a subject to which further reference is made elsewhere. (*Vide* amyl nitrite and sinusoidal current in diagnosis.)

Nervous dyspeptics show improved digestion after the bromids have been used in sufficiently large doses for several days. In other words, this therapeutic test enables us to differentiate gastric symptoms dependent on lesions of the viscus from those caused by an exhausted nervous system. Anesthesin could be used for the same diagnostic object. The laryngologist frequently employs the bromids to antagonize the pharyngo-laryngeal reflexes, with the object of facilitating examination.

ANTHELMINTICS.

These are drugs which kill (vermicides) or expel (vermifuges) intestinal worms. Their use is indicated when we wish to make a diagnosis by exclusion. The reputation of the "tape-worm specialist" is based on the negligence of the physician. Intestinal worms exist with or without symptoms. A patient suffering from a malady which bears no relation to helminthiasis, having run the gamut of physicians, goes to the specialist, who attributes every possible disease to worms. He gives the sufferer an anthelmintic, and behold! a worm is expelled. Suggestion does the rest, and the patient is temporarily or permanently cured of his ailment. Worms cause few definite symptoms. Some complain of abdominal sensations of various kinds—ravenous appetite, indigestion, nausea, and diarrhea. In others we find profound mental depression. Whether such major conditions as epilepsy, chorea, and convulsions are caused by worms is not certain. More frequent symptoms in children are: tickling of the nose, salivation, itching of the anus, nausea, twitchings, grinding of the teeth, irritability, and restlessness. In suspected helminthiasis a systematic examination of the stool will show segments of the worm or the ova by microscopic examination. To facilitate the *detection of eggs* of parasites in the stools, Telemann takes pieces about the size of a pea from five different parts of the stool to be examined, and mixes them in a reagent glass filled with equal parts of ether and pure hydrochloric acid. In this mixture the stool rapidly dissolves when shaken. It is then passed through a fine hair sieve, and the filtrate is centrifugated for about a minute. The insoluble relics of the food and the eggs of parasites will be found in the tip of the centrifugal tubes. By this means one can discover the eggs even when they are very scanty. If the segments are not discoverable, a mild purgative will assist in their expulsion. Certain kinds of food also act mechanically in this regard, viz., seeds of strawberries and blackberries, figs, husks of grain, as well as highly seasoned food, strongly salted meat, etc. It is also well to remember that even small doses of some anthelmintic plus a purgative will aid in the recognition of ova or other products in the feces. Mucus and undigested food are often mistaken for parasites by the patient. A microscopic examination of the segment with a low power will enable us to say whether we are dealing with a pork or beef tape-worm. This is important in prophylaxis, to prevent recurrence. If the segment is pressed out between two object-glasses, even the unaided eye will determine the source of the segment.

Jefinow[302] asserts that intestinal worms excrete a toxin which is excreted in the urine. For two days before applying the test no drugs should be given to the patient, insomuch as a number of them (sodium bicarbonate and other alkalies, salts of iron, salicylates, etc.) give a similar reaction. Albumin, sugar, and indican do not influence the test, although pus may. The test for the toxin is made by boiling a small quantity of urine and then adding a few drops of fluid nitrate of mercury. If there are no intestinal parasites, the urine becomes milky, and a white precipitate is finally thrown down; otherwise it turns a gray or black color. What most concerns the physician are the tape-worms, or teniæ, round-worms, and the seat- or pin-worms. Each has its own treatment.

Tape-worm.—The mode of procedure is the essence of the treatment. A very light diet should precede the remedy for several days, and if possible, no food should be ingested for a day. On the two days preceding the administration of the drug, a mild purgative should be taken each day. If the preceding is impracticable, give the drug before breakfast and warn the patient to take a light supper of liquid food. I have never known the following to fail: Make an infusion of pomegranate root, ½ oz.; pumpkin seeds, 1 oz.; powdered ergot, 1 dram; boiling water, 10 oz. To this is added an emulsion composed of ethereal extract of male-fern, 1 dram; croton oil, 2 minims; and acacia powder, *q. s.* This mixture, as before remarked, is taken in the morning (Sunday, when the patient is at home), before breakfast. If hot water is put in the commode, the worm is less likely to be broken. Care must be taken to recognize the head of the worm, for if it is not expelled, the worm will continue to grow again in the intestines. If the foregoing mixture should nauseate, cocainize the pharyngeal mucosa and give cocain internally (¼ to 1 grain).

Among other drugs may be mentioned:

Tannate of pelletierin, of which 5 to 10 grains are given after the usual preparations are made. A large glassful of water should be drunk ten minutes afterward, and half an hour later a couple of ounces of infusion of senna or other purgative should be taken.

Pumpkin seeds (1 oz.), pounded up with sugar and honey into a paste, may be eaten, and is a mild teniacide for children. It should be followed in an hour by a purge.

Thymol has been found efficient, and is given in capsules of 10 grains each, and one capsule given every quarter of an hour until 1 dram is taken, followed by a purgative.

Naphthalin is also used in doses of from 2 to 20 grains, mixed with powdered sugar, twice a day.

Round-worm (*Ascaris Lumbricoides*).—This worm is more frequent in children than in adults. It is a cylindrical worm, the female being 6 to 12 inches long (male smaller), and tapers at each end. A number may be present at one time. The female's eggs are discharged in the evacuations in large numbers. There are three drugs which are efficacious for this worm: viz., santonin, spigelia, and chenopodium. The same preparation is necessary as described (*vide supra*) before giving any drugs.

Santonin is very efficient, but must be used cautiously, owing to toxic symptoms which may develop. It is usually prescribed in lozenges. The dose for a child under two years should not exceed ½ grain, and under five years, not more than 1 grain. The dose for an adult is 1 to 5 grains. Give a lozenge of santonin night and morning, and follow the next day with castor oil or a few grains of calomel. Lozenges may be made containing a grain each of calomel and santonin. Give a copious rectal injection of salt water after the action of the purgative, to wash out any additional worms that have been lodged in the rectum—a procedure which, according to Hare, will often secure the head of a tape-worm.

Spigelia is a safe and efficient remedy if used with care. The adult dose of the fluidextract is ½ to 2 fldr.

Chenopodium is less agreeable than the foregoing, but is reliable. The oil is usually prescribed in an emulsion or given on sugar, and the adult dose is 3 to 10 minims.

Thread-worm (*Oxyuris Vermicularis*).—The length of the female is about ⅜ inch, and the male is about one-half of that length. It inhabits any part of the intestine, from the jejunum to the anus. Thread-worms are most frequent in children. They produce much itching, particularly at night, in the rectum and neighborhood. They may wander into the vagina, and, irrespective of the latter fact, they irritate the sexual organs and give rise to masturbation, erections, nymphomania, etc. The children are usually nervous and anemic. Helminthologists often find the dislodgment of thread-worms a difficult task. If their habitat were only the rectum, the task would be easy, but they must be dislodged from their favorite nidus, the cecum, and from the vermiform appendix.

Santonin is a favorite remedy combined with purgatives, especially rhubarb, and so is **spigelia.** In connection with an internal remedy, enemata are used to dislodge the worms from the rectum. In order of potency the following drugs are used:

Quassia.—A cold infusion (1 oz. to 1 pint of water).

Salt.—Two teaspoonfuls to a pint of water.

Naphthalin.—Fifteen to 20 grains in about 2 ounces of olive oil.

Lime-water.—Four to 6 ounces as an enema.

Perchlorid of Iron.—A solution of 5 per cent. used every night for about one week.

In all instances a cleansing enema of soap and water should precede the use of the anthelmintic, and in many instances washing of the entire length of the large intestine may be necessary. Where an enema is objectionable, mercurial ointment diluted with vaselin or employed as a suppository may be used.

Ankylostomiasis.—In this disease the hook-worm inhabits usually the small intestine. Anemia is the chief symptom, associated later with edema. Eosinophilia is present in 94 per cent. of the cases. The use of **thymol** will cause the expulsion of the characteristic eggs in the stools, if not otherwise demonstrable. If a portion of the feces is placed upon white blotting-paper and allowed to stand for an hour, a reddish-brown stain, suggestive of blood, appears. This is the blotting-paper test. Thymol is practically a specific. After preliminary dieting and the use of purgatives, ½ dram of this drug is given, and repeated twice after intervals of two hours, followed by a dose of castor oil. In weak patients a smaller dose of thymol must be used. The thymol treatment must be continued until the microscope shows that the ova are no longer present in the stools.

ANTIMALARIALS.

Quinin.—The physiologic action of this drug is closely identified with its toxic action (*cinchonism*). The diagnosis of *malaria* by means of quinin is one of the most exact tests in diagnostic therapeutics. Any intermittent fever which fails to yield to quinin is not malarial, and any complications or sequelæ which are supposed to be of malarial origin must yield to the same drug, otherwise the malarial genesis can be excluded.* Some of the sequelæ of malaria may be caused by anemia, which varies in severity according to the number of red corpuscles destroyed by the malarial parasites, hence *iron* may be indicated. In applying the therapeutic test, we must know how and when to give quinin, and, above all, we must push it to saturation. As a rule, all the effects of the drug can be obtained in giving it by the mouth. It may be prescribed in capsules or in solution. Pills are usually old and the quinin escapes absorption. The safest way to give quinin is in solution with a mineral acid: quinin sulphate, 5 grains; dilute hydrochloric acid, 5 minims; water, to 1 dram. Even when given in capsule the solubility of the quinin is aided if followed by 10 minims of dilute mineral acid. Vanderhoof tells of a patient who was brought into the hospital in a state of collapse, whose blood presented an extreme picture of pernicious malaria. He died in a few hours, and at the autopsy an ischiorectal abscess was found which contained in its pocket-like recess a number of quinin pills which had passed through the intestine without being at all dissolved. The taste of the drug may be disguised in solution by syrup of yerba santa or licorice elixir. *Euquinin* is a tasteless substitute for quinin.

When it is desired to get the patient quickly under the effects of the drug, or when used in unconscious patients who cannot swallow, the drug can be given hypodermatically. Either the dihydrochlorate, in 15- to 20-grain doses every three hours, or the muriate of quinin and urea, in 10- to 20-grain doses, may be given. The use of a large syringe holding 1 ounce enables us to dilute the quinin solution and thus avoid much of the pain of the injection.

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* A single hypodermic injection of 15 grains of quinin and urea hydrochlorid will, in *malaria*, cause a "freedom period" lasting either 6½ or 13 days (S. Solis Cohen). A small dose (0.3 to 1 gram), at intervals of three days to one week (about half a dozen injections), will often enable one to demonstrate plasmodia in the peripheral blood although previously absent (Billings).

Some use the hypodermatic route as a routine method. Thus Johnson, of the Indian Medical Service, injects 4 grains of the neutral sulphate, and claims that recovery is quicker and more permanent and that one-fifth of the amount of quinin (when given by the mouth) is required. Dr. Ferguson used the acid hydrobromid in 3-grain doses dissolved in 20 minims of warm water, and he affirms that no case will resist six subcutaneous doses of 3 grains each of quinin hydrobromid. The hypodermatic use of the drug is rapidly gaining converts. Intramuscular injections are used, and the glutei muscles are ordinarily employed, although the deltoid and biceps may also be used.

Quinin is also given by the rectum as a high enema. The intravenous route is also advocated, but I believe that the use of the drug hypodermatically has all the advantages without the disadvantages of the venous route. Regarding the time of administration, it has been shown that quinin is most effective when the parasites are free in the circulation, viz., at or just before the paroxysm. However, others claim that it is equally as effective between the paroxysms. Usually when the drug is given during the febrile paroxysm, the symptoms are accentuated.

Disregarding all theory respecting its administration, the practical point to remember is to keep the patient under the influence of the drug by means of large or divided doses; to use the quinin until the symptoms of cinchonism have developed, discontinue it then, and administer it again when cinchonism has disappeared, and so proceed until the disease has been effectually controlled. The efficacy of quinin is always increased by the administration of calomel, which assists in the removal of hemoglobin débris in the liver. A nostrum of India, known as Warburg's tincture, and employed successfully in the treatment of malaria, is composed essentially of laxatives. Many clinicians, notably Holt, claim that relatively much larger doses of quinin are required for children than for adults, and 8 to 12 grains of the sulphate daily is not an extraordinary dose for an infant of a year.*

Quinin is a vasoconstrictor, and this fact has been utilized by Lancereaux and Paulesco in the treatment of exophthalmic goiter, which is associated with dilatation of the vessels of the head and neck. Quinin in doses of 50 centigrams at meals was given for weeks and months to twenty such patients, and cure was noted. Pain of *splenic origin* is usually caused by augmented tension of the capsule, hence quinin, which will diminish the size of the organ, will also relieve the pain.

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* Urobilinuria is a sign of *latent malaria* and urobilin is detected as follows: To the unfiltered urine add an equal quantity of a solution of 10 parts of zinc acetate in absolute alcohol. Shake and add a few drops of Lugol's solution and shake again. If urobilin is present, the filtered mixture shows fluorescence.

Doses: *Quiniæ Sulphas, Bisulphas, Hydrochloridum, Hydrobromidum*, 1 to 30 grains. *Quiniæ Dihydrochloridum*, 1 to 30 grains. *Quinin and Urea Hydrochlorid*, 1 to 20 grains.

Arsenic has been advocated as a substitute for quinin, but its action as an antimalarial is still debatable.

Methylene-blue is used as a substitute for quinin in malaria, and while many concede that it is endowed with some virtue, it is, like all other substitutes, inferior to that of quinin. Dose, 1 to 4 grains. Given by the mouth or subcutaneously, it soon appears in the urine, imparting to the latter a blue or greenish-blue color. The feces also become blue on exposure to air. This drug is said to be especially efficacious in chronic malaria. The dose is about 5 grains after meals, and it is usually prescribed with powdered nutmeg to prevent the tendency to strangury.

Vincent's angina has lately been described. It is an acute febrile affection resembling diphtheria. There is a soft, yellowish-green exudate in the throat, which on removal leaves a bleeding ulcer. The glands of the neck are usually involved, and in many instances the throat ulceration is of a destructive character. The bacillus fusiformis is associated with the affection. Several specialists in Paris have told me that methylene-blue is a specific in this form of angina, and that dusted over the surface of the throat within twelve hours, the affection is practically controlled. The drug in question is an analgesic.

In *cystoscopic examinations* Fisher[43] gives the patient 7½ grains of methylene-blue in a capsule two hours before the examination. The ureters are more easily demonstrated because they secrete a blue cloud of urine, and all ulcerated patches and papillomatous tissue appear blue because all pathologic take up the stain better than do normal tissues.

Others (Voelcker,[175] Vallicher, Joseph[176]) prefer an intramuscular injection of a 4 per cent. solution of indigo-carmin for *chromocystoscopy*. Elimination commences in twenty minutes and ceases in two hours. The depth of staining of the urines during the elimination gives an approximate idea of the functional value of the two kidneys, either by the cystoscope or, more accurately, by examining the collected separate urines (page 435). Beer[218] directs attention to the diagnosis of *pyelonephritis*, based on the retention and the delayed excretion of methylene-blue. Ordinarily it is difficult to say whether the parenchyma is involved; *i. e.*, whether there is a pyelonephritis or simply an involvement of the pelvis of the organ (pyelitis) without implication of the parenchyma of the kidney. By administration of methylene-blue, it is deposited in the parenchymatous abscesses for years, hence the continuous discharge of blue-stained pus indicates the rupture of parenchymatous abscesses into the pelvis of the kidney and shows that the parenchyma is involved (pyelonephritis). Beer does not refer to the various renal and hepatic lesions which cause a delayed and intermittent excretion of methylene-blue (page 839), but I would assume that his method could only be regarded as diagnostic provided there was a recurrent discharge of the drug for weeks or months after a single administration, and after the primary excretion of methylene-blue had ceased. As a rule, methylene-blue given by the mouth disappears from the urine in three to six days.

Sahli's desmoid test,[44] for determining the *functions of the stomach*, consists of using a little rubber bag containing methylene-blue, which is tied tightly with thin raw catgut. The desmoid bag is swallowed after a large meal. The reaction (blue urine) in healthy persons occurs from six to eight hours after ingestion of the bag. A blue color of the urine appearing early (four to six hours) speaks for hyperacidity. In subacidity or motor insufficiency the reaction does not occur until the following day. The test is based on the fact that the catgut and rubber are impermeable to the intestinal and pancreatic juices, but that in normal gastric digestion the catgut string is dissolved, thus permitting the absorption of methylene-blue. Sahli suggested this method for those in whom the stomach-tube cannot be used, and because in many instances it was a better index of gastric digestion than the usual one of chemic analysis of the stomach contents after removal of the latter by a stomach-tube. Einhorn[45] and Monod[46] refer to the drawbacks of this method. The former shows that catgut is also digested in the bowel, and the latter demonstrated that it does not show when an excess of acid is present. For the latter reasons the test must be discredited.

Whatever conception we may have concerning *masturbation* of both sexes in the etiology of disease, we are at least certain of this, that, practised moderately and for a short period in youth, the evils are chiefly mental, developed from the loss of self-respect and the sense of unmanliness. In women masturbation is suggested by vulvar hypertrophy, and in children by hypertrophy of the prepuce. The usual time of indulgence is at the termination of menstruation. Kelly affirms that in the diagnosis of masturbation one can safely say that no well-marked area of corrugation about the female genitals is produced in any way but by pressures. I have frequently used an ointment colored with methylene-blue for detecting masturbation. The mother is instructed to bathe the genitalia at night and to place within the vulva or on the male organ a little of the salve. A T-bandage is then applied. The mother is not informed of the object of the procedure, but is told to note whether the fingers of the patient are stained in the morning. The physician of experience knows that in the infant the hands are not always employed in masturbation, but that the act is often accomplished by friction of the thighs and by means of postures which approximate the genitals with certain objects. This salve may be used for a multitude of purposes—to determine whether the patient scratches the nose or rectum at night, or picks at skin lesions undergoing treatment, etc. One of my patients had the obsession that he unconsciously practised masturbation at night, and the use of the salve convinced him to the contrary.

Davis[204] suggests that before operating on *fistulas* the fistulous passages should be injected with a 6 per cent. solution of methylene-blue in 50 per cent. of alcohol. The exact site of the rectal opening of fistulas may also be demonstrated by inserting a strip of gauze into the rectum and injecting into the external orifice of the fistula a 1 per cent. solution of methylene-blue. If there is any communication between the fistula and the rectum, it will be indicated by the bluish stain on the gauze. Milk and a solution of potassium permanganate have also been employed for determining whether a fistula is complete or otherwise.

A methylene-blue solution injected into a *cyst* will define the extent of the cyst wall and thus aid in the complete removal of the latter.

In the diagnosis of a posterior *urethritis*, after the anterior urethra is irrigated with saline solution until the outflow is perfectly clear, all cloudiness and flocculi found in the urine must then come from the posterior urethra and the bladder. Another method is to employ an injection into the anterior urethra of methylene-blue or permanganate of potash, which is retained for a few minutes. If many flocculi are unstained in the urine, posterior urethritis exists.

Methylene-blue is often employed by charlatans as a vehicle for *suggestion*. Thus, some direct the patient to take a capsule containing the drug, and if the urine turns green or blue, it indicates renal disease. Another may direct the patient to dip pieces of cloth into the colored urine, and, after being dried, they are sent to him for examination. Another informs the patient that the good effects of his medicine are revealed by the colored urine. I once had a patient with a cardiac neurosis which failed to yield to my treatment. She went to a quack and was cured. He gave her capsules of the drug in question, informing her that poisons had accumulated in her heart and that she would note their elimination by the coloring of the urine.

Coughs are frequently excited from the nasopharynx. The usual causes are adenoids and the discharge in nasopharyngeal catarrh. In children a cough dependent on adenoids is comparatively common. The cough is worse in damp than in dry weather. The "morning cough," in which large quantities of sputum are brought up, is a frequent symptom of nasopharyngeal catarrh. It is often difficult to say whether the sputum arises from the nasopharynx or deeper down in the respiratory tract. This is important to determine in diagnosis; thus, after the cure of tuberculosis, persistent expectoration may continue in consequence of nasopharyngeal catarrh. Treatment of the latter would decide the question, but a diagnosis thus established is a tedious matter. I employ the following method: Remove the secretion from the nasopharynx and note the elements microscopically. I instruct the patient to bring some of the sputum for examination. Examine the latter microscopically, and if the microscopic elements correspond with those from the nasopharynx at the previous examination, one is justified in concluding that the expectoration is largely of nasopharyngeal genesis. Another method which I use is to spray the nostrils with oil colored by methylene-blue. If the sputum is stained, it is good evidence that the secretion is derived from the nasal cavity. To lessen excessive nasal secretion a diluted belladonna ointment containing tannin or gallic acid may be applied directly to the nasal mucosa.

Hemoptysis may be confounded with nose-bleed which has occurred during sleep. Here the use of the pigment after the foregoing method may aid in diagnosis. The gastric origin of hemorrhage is usually differentiated from hemoptysis by the bright-red, frothy, and alkaline character of the blood in the latter condition. The patient is not always able to say whether blood or sputum is coughed or vomited. A capsule containing methylene-blue will decide the question.

It is often difficult to detect the pinhole openings of *vesico-vaginal fistulas*. Here capsules of methylene-blue can be administered by the stomach, and the escape of colored urine is easily recognized by a vaginal examination. The bladder must be allowed to become distended with urine. Another method is to inject a solution of the same drug into the bladder. The Bozeman test is based upon the fact that urine passes through linen and the vaginal secretions do not. After drying the suspected location of the fistula, thin linen is spread upon it, and then watched for the point of moisture to appear. Other vesical fistulas are similarly determined.

Examination of the blood in *diabetes* may prove of value in diagnosis when urine is not available. Williamson's test is as follows: In a small test-tube place 40 c.mm. of distilled water. With Gowers' pipette procure 20 c.mm. of blood from the punctured finger and expel it into the water. Next add 1 c.c. of an aqueous methylene-blue solution (1 : 6000) and 40 c.mm. of a 6 per cent. aqueous solution of potassium hydrate. Another tube is similarly prepared for control with non-diabetic blood. Both tubes are placed in boiling water for four minutes. Diabetic blood becomes a dingy yellow, whereas the control tube remains bluish-green.

ANTINEURALGICS.

The symptomatic treatment of neuralgia is the relief of pain by the use of analgesics. There are, however, certain constitutional conditions which predispose to pain, which, when corrected, will cure the neuralgia; in other words, the efficacy of such treatment will make the etiologic diagnosis. First of all, having excluded neuralgia as a symptom of some affection of the central nervous system, we look for a traumatic or mechanic cause. We search for a growth compressing the nerve, scars, periostitis, or an inflammation of the nerve itself. In neuralgia of the lower extremity examination of the rectum, vagina, and hernial rings must not be neglected. In neuralgias of the head, one must never neglect to examine the teeth.

Malarial neuralgias do exist, but their frequency has been exaggerated. The diagnosis is usually based on the fact that the neuralgia recurs periodically. The fact is, neuralgia is not a constant but a paroxysmal pain, and this is a conspicuous symptomatic feature.

However, quinin may be tried, but one must not conclude that the pain is malarial unless permanently relieved by quinin treatment. The drug possesses analgesic properties and relieves pain, irrespective of cause. Neuralgia is often the initial symptom of many infectious diseases. In a syphilitic subject we must try our antisyphilitic remedies. I have observed many cases of neuralgia, particularly those of the head, which were unquestionably of rheumatic origin. These neuralgias yielded eventually to large and continuous doses of the salicylates. The usual history of the subject with *rheumatic neuralgia* is that the pain is always accentuated when the weather changes. Some of my intelligent patients kept accurate records and noted that their pains always corresponded with a fall of the mercury in the barometer. In many of these patients I would direct a current of compressed air over the region of the pain, notably at the vertebral exits of the spinal nerves, and in most instances a typic neuralgic paroxysm could be provoked. I have often found that many barometric neuroses are favorably influenced by the salicylates, and it is manifestly an error to suppose that pain is the only manifestation of rheumatism. In *gouty neuralgias colchicum* is a specific. *Anemic neuralgias* require *iron*, and it is a safe procedure to use iron as a routine method of treatment in all cases. Arsenic may be used in combination with the iron.

Diabetes is a frequent etiologic factor, and in neuralgias of diabetic origin diet is the only means of cure. We have neuralgias in *neurotic subjects*, especially in those who have lost in weight. Here the insulating fat of the nerves is lost and the nerves react rapidly to all kinds of insults to which normal nerves would prove refractory. Here there is only one method of treatment: replace the fat by forced feeding or, better still, by means of a rest cure. It is well to remember that neuralgia may be of tabetic origin (*tabetic neuralgia*) without loss of the knee-jerks. The pain is characterized by the fact that it leaves the skin sensitive, *i. e.*, the mere touch of the affected area elicits the sensation of an open sore, even though the area has lost its sensibility to the prick of a pin.

Indefinite pains in the precordium or in the left upper extremity relieved by the inhalation of amyl nitrite or after the administration of nitroglycerin or erythrol tetranitrate suggest a cardiac origin (angina pectoris).

Doubtful pain, notably in proximity to the thorax, if intensified by the employment of *tuberculin*, suggests a tuberculous origin. There are two drugs which seem to possess a specific influence in *facial neuralgia*—croton-chloral, also called butyl-chloral hydrate, and gelsemium.

Butyl-chloral is best given in capsules, on account of its bitter taste and because solutions decompose. The dose is 5 to 20 grains. If 3-grain capsules, given every hour until four capsules have been taken, do not relieve, then the drug usually fails to act at all.

Gelsemium.—This is given alone or in combination with butyl-chloral. Preparations vary in strength, hence it must be given in small and repeated doses until dizziness or dimness of vision appears. The fluidextract of the preparation is given in 5-minim doses, repeated every four hours until some effect is produced. The dose of the fluidextract of the drug is 10 to 20 minims.*

ANTIPYRETICS.

We have already referred to the interfering influence of antipyretics in diagnosis. Let us now learn the value of this class of drugs in diagnosis.

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* I employ the following efficient analgesic formula for a single dose, which may be repeated if necessary: Caffein, gr. 2; pyramidon, gr. 5; phenacetin, gr. 5; sodium bicarbonate, gr. 10; sodium bromid, gr. 20. Owing to its deliquescence, the powders are dispensed in homeopathic vials.

Elevation of temperature in fever is only one of a number of phenomena, and it is difficult to say whether the symptoms are produced by the high temperature or by the factor which provokes the latter. The normal heat of the body is derived from the oxidation of food-stuffs and a number of mechanical movements, and the loss is effected by conduction and radiation from the skin and by evaporation of water from the skin and lungs. The normal regulation of heat production and dissipation is controlled by the central nervous system. Antipyretics have only a slight or no influence at all on normal temperature, but they lower the temperature in fever, with symptoms of depression more or less pronounced. There are various influences which elevate temperature which, if eliminated, reduce the latter and thus act as antipyretics. Such influences are mechanic and chemic. Thus, muscular action will set free in the body large quantities of heat; therefore absolute rest in bed is, in a certain sense, an antipyretic. We know, according to the experiments of Rubner, that the heat production in dogs could be increased 60 per cent. by feeding them with large quantities of proteid food. The character and the quantity of food will influence the febrile temperature.

Bacterial fever is caused by the entrance into the blood of living or dead bacteria or their products. It has been found that fever can be produced experimentally by injections of isolated proteid bodies from bacteria. Thus it is that certain drugs possess a specific influence in certain fevers, not by influencing the fever itself, but by acting on the factors which provoke the latter. Examples of such drugs are: salicylates in rheumatism, quinin in influenza and malaria, and mercury in syphilitic fever.

Syphilitic fever, which usually attends the secondary symptoms of syphilis, may occur at any period of the disease. It is often of an intermittent character, lasting for months, and has been mistaken for malaria, typhoid fever, and tuberculosis. It is frequently possible to determine the influence of micro-organisms in gastric disease on temperature by lavage of the stomach, and similarly the use of purgatives will acquaint us with the influence, if any, of septic intestinal conditions. Bacterial products often fail not only to produce a rise, but actually cause a subnormal temperature. In such instances it is possible that the thermogenic center, like other vital centers, is so overwhelmed by the poisons that its irritability is lost, for such subnormal temperature is frequently encountered in some of the most malignant infections. We must recall the fact that *leukocytosis* is an essential condition, necessary to combat infection; hence in bacterial infections cold baths are preferable to the antipyretics for reducing temperature, insomuch as the latter check leukocytosis. In *blood-infection* due to a local lesion the symptoms should subside within seventy-two hours after the lesion has been properly treated.

In persons who have had malaria, an operation which taxes the vital powers may provoke a recurrence. This fact will often exclude a septic process as a cause of pyrexia.

Aseptic Fever.—While we recognize bacteria and their products as the most constant causes of pyrexia, we know that fever may occur independently of microbic invasion in conditions which cause an extensive destruction of cells in the body with abnormal proteid decomposition. It is for this reason that some entertain a chemic theory of fever. We know that after the injection of many aseptic organic compounds and salts elevations of temperature may follow. It is in augmented metabolism that quinin acts most advantageously as an antipyretic. It has been demonstrated that quinin reduces the nitrogenous excretions (urea, uric acid, and carbonic acid). The total solids excreted by the urine may drop 40 per cent. within twenty-four hours after a single dose of quinin, and it is eliminated unchanged by the kidneys. It is supposed that quinin combines with the living protoplasm, reducing the ability of the latter to take up oxygen, and thus making it resistant to vital change.

Many forms of fermentation are inhibited by quinin, and an albumin solution cannot be converted into peptone in an ozone atmosphere in the presence of quinin.

Nervous Fever.—It is quite evident that the nervous center regulating temperature may be primarily diseased, or more often its mechanism is disturbed by impulses arising elsewhere in the nervous system. This mechanism implicates not only the thermogenic center, but the thermo-inhibitory and heat-dissipating mechanism. In many neurotic families high body-temperatures are provoked by the most trivial causes, and we note the same tendency in malnourished bodies. Elevation of temperature may occur reflexly, and the source of irritation may be a foreign body in the intestinal canal, undigested food, or the cutting of a tooth. Ott has noted an elevation of temperature following sciatic irritation after the use of atropin.

Fever is an occasional accompaniment of hysteria (*hysterical fever*). It may be associated with some local disturbance of an hysterical character and may lead to much confusion in diagnosis. Thus we have pseudo-phthisis and pseudo-meningitis accompanied by fever. Respecting the question of hysterical hyperpyrexia, it is very difficult to exclude fraud, unless the physician takes the temperature himself; yet even where the physician has controlled the thermometer, temperatures of 120° have been recorded in hysterical women. We cannot deny a nervous influence in pyrexias. In many infectious diseases, where the temperature was not controlled by antipyretics, I have frequently used codein, and even morphin, to advantage, and in this way I was able to determine the nervous element concerned in the pyrexia. Such sedatives act by making the mythical heat center resistant to stimuli, and control muscular movements in restless patients, which are alone capable of raising the temperature. Muscular energy is associated with the evolution of heat.

Direct *calorimetry* has been employed to determine the effects of drugs on temperature. The temperature of the body depends on the balance between heat production and heat dissipation, and the latter is greater in dilatation of the cutaneous vessels, with increased formation of sweat and with more vigorous respiration, which dissipates heat in the expired air and increases evaporation in the air-passages. The factors mentioned for dissipating heat are controlled respectively by the vasomotor, sweat, and respiratory centers. The following drugs affect heat production more than heat dissipation, hence the temperature rises: atropin, caffein, cocain, pepsin, solanin, and strychnin. The latter increases heat production in small doses and its effects are counteracted by chloral. The following drugs affect heat dissipation more than heat production, hence the temperature falls: antifebrin, carbolic acid, chloral, and thallin.

Antipyrin.—This drug is essentially an analgesic, and, as Martinet[67] puts it, you may secure general anesthesia without sleep. Its internal administration causes a peripheral vasodilation, characterized by flushing, notably of the face, whereas its local application to a mucous membrane causes a rapid ischemia and anesthesia of variable duration. Huchard employs antipyrin for diagnostic purposes, to differentiate the pains of true and false *angina pectoris*. The pains of the latter are at once subdued by a sufficiently large dose of the drug, whereas in true angina there is no relief; in fact, the pains may be accentuated, owing to the internal vasoconstriction resulting from the drug. Antipyrin is freely soluble in water and the dose is 3 to 15 grains.

Pertussis is easy to diagnose when the characteristic "whoop" is present, but when the latter is absent, or not developed until the paroxysmal stage, we are frequently in doubt concerning the origin of the annoying cough in the child. In such cases the relief afforded by antipyrin in very small doses is almost diagnostic. A paroxysm may often be aborted by pressing the lower jaw downward and forward, as in asphyxia, and mothers and nurses should be taught this simple and often efficient maneuver.

Pyramidon.—This drug is three times as active as antipyrin, and its action is of longer duration. It is now being used in typhoid fever, and former adherents of the hydropathic treatment of this disease claim that better results are achieved with pyramidon. About 5 grains of the drug are usually given to reduce the fever, and if this does not suffice, it is increased to 8 grains, given in water. After the fever has subsided, 2 grains per day are given. A red color imparted to the urine is not an index of the toxic action of the drug; on the contrary, it is an indication that pyramidon has performed its duty, as some suppose.

ANTIRHEUMATICS.

The only reliable antirheumatics are the *salicylates*, and although substitutes have been suggested, the only substitute that is entitled to any consideration is *aspirin*, although in efficacy it cannot compare to the salicylates. The untoward effects of the latter have been discussed in a previous chapter. The physiologic action of the salicylates is identified with their therapeutic effects, viz., deafness and tinnitus. Most pronounced toxic symptoms may follow the use of the salicylates, and in such instances we are using impure preparations. Only the natural or the physiologically pure preparations should be used.

Salicylic acid has a decided action upon the excretion of uric acid, especially in *gout*, and doses of 3 to 6 grains are succeeded by an augmented uric acid output in healthy and diseased persons up to 3 decigrams and more (Magnus-Levy and others).

The Salicylates.—*Preparations.*—*Acidum salicylicum*, 5 to 20 grains; *sodii salicylas*, 5 to 20 grains; *salicinum*, 10 to 40 grains. Sodium salicylate is the salicylic acid salt most frequently employed. It is more soluble in water and produces less gastric irritation than the other salicylic compounds. Salicin is supposed to be less depressing and is used in children. Here reference is especially made to sodium salicylate.

Therapeutic Effects.—The sodium salt is given in rheumatism in doses of from 10 to 20 grains every hour until deafness or tinnitus occurs. Its use is then suspended, and resumed when the symptoms mentioned are arrested, and after this manner suspended and resumed on the appearance and disappearance of toxic symptoms. Large doses may thus be tolerated. Usually on the second day there is a decided fall of the temperature and relief from pain. The joint swelling usually disappears on the third or fourth day. It is wise in carrying out the foregoing method to employ the alkaline treatment, which consists in giving some effervescent preparation of potassium bicarbonate or acetate with sodium salicylate until the urine is alkaline. When the latter reaction is obtained, the effervescent salt may be reduced, but the alkalinity of the urine must be maintained during treatment. There is much reason to believe that cardiac complications are less frequent with the alkaline treatment. The alkaline treatment is also indicated because the diplococcus of rheumatism possesses powerful acid-producing properties.

Diagnosis.—McCrae,[47] and more recently Thomas Clarke,[48] have directed attention to the diagnosis of various forms of arthritis by the use of the salicylates. The true rheumatic can tolerate from 150 to 300 grains of the sodium salt before toxic symptoms occur, whereas in other forms of arthritis such symptoms develop after smaller doses. Thus in *gonococcic arthritis* the average amount necessary to provoke toxic symptoms was 131 grains. In true rheumatism the fever, pain, and swelling disappear in two or three days, whereas in other forms of arthritis, while the temperature may fall to normal, there is no change in the swollen joints. True, such patients may complain temporarily of less pain, but this is caused by the toxic effects of the drug on the sensorium, for when the effects of the drug wear off, the pain is as acute as before. In brief, one may conclude that if the symptoms subside rapidly, the diagnosis of rheumatism is practically absolute, otherwise an articular affection of another nature may be assumed to exist. Whenever the strength of the patient has been severely taxed as the result of malnutrition or otherwise, the salicylates seem to lose their potency as antirheumatics. The so-called subacute forms of rheumatism respond less readily to the salicylates, but it is then questionable whether the affection is essentially rheumatism. There is little need to employ the salicylates for diagnostic purposes in the readily recognized classic types of rheumatism, but in the atypic forms of the disease and in the *rheumatism of children* the salicylates are indispensable. Graves observed that in rheumatism fever may occur without any joint affection, and that the endocardium, pericardium, or pleura may be affected alone. The observation of Graves has been corroborated by others in children. In the latter arthritic symptoms are often absent, and among the manifestations may be chorea, tonsillitis, pleurisy, persistent headaches, muscular pains, etc. Anemia (*rheumatic anemia*) may be the only symptom of rheumatism in a child (Joseph E. Winter).*

A sore throat in children, coupled with high fever and a tendency to sweating, may be the only evidence of rheumatism, and here the salicylates, by their beneficial action, demonstrate the nature of the trouble. The records of the Vanderbilt Clinic of New York give the proportion of cases of tonsillitis in rheumatism at 35 per cent., and many facts show that the tonsils represent the portals of entrance of the rheumatic organism. The word rheumatism is unquestionably abused, and is found identified with many affections, neuralgic, muscular, and articular, in which a real rheumatic element is absent. *Growth fever* is not necessarily rheumatic, although the salicylates are useful for relieving the pain. The affection is characterized by deep tenderness near a joint, rapid growth of a limb (determined by measuring), and slight fever. It occurs between the ages of seven and fifteen, and the pain quickly subsides after several days' rest in bed. The so-called rheumatic purpura in not always rheumatic, insomuch as a rheumatic history can be elicited in less than one-third of the cases. The salicylates, used only after the manner indicated, will assist in solving the diagnosis, but if they are used in the conventional meticulous way, they are absolutely of no value in making a diagnosis.

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* In rheumatism in children, the joints largely escape and the earliest possible recognition of the disease can be made by noting the functional incapacity of the heart. Kerr suggests the following test: give the child a small dose of tincture of digitalis (1 minim to a child of seven years). If there is an appreciable difference in the rate or quality of the pulse, it is suggestive of functional perversion.

The presence of *rheumatic nodules* may assist in the diagnosis of rheumatism. They are more common in children than in adults. They are small, subcutaneous nodules attached to the tendons and fasciæ of the fingers, hands, and wrists, and are found less often in other situations (elbows, knees, vertebral spines, and scapulæ). They may persist for months. It is now customary to regard rheumatic fever as a mild pyogenic infection, but one of the most positive arguments against this hypothesis is the fact that the salicylates, while specific in action in rheumatism, are without influence in septic infections. Haig[300] observes that salicylates may show no favorable action in rheumatism if the patient is debilitated or if the joints are incased in cotton-wool. In the latter case it is generally sufficient to remove the wrappings and keep the joints cool to insure a speedy and satisfactory convalescence. Heat and perspiration interfere with the action of the salicylates. Thus it is that in hot climates the salicylates are often so inefficient in rheumatism that some have observed that the arthritis encountered in hot climates is not rheumatism. Therefore, to secure the best effects from the salicylates, the patients must be kept cool and ice applied to the joints. It is a common experience, continues Haig, that fractures of bone or old scars in fibrous tissue generally react to changes of weather and season by some increase of local irritation or pain, and this is so because they form centers of defective circulation and diminished alkalinity in which urates most tend to congregate; but let such sufferers shut out (as far as possible) urate compounds or xanthin from their food, and in a few years' time, when the tissues begin to get relatively clear, such irritations will cease to trouble and salicylates will no longer be required to relieve. He also mentions that in many of these local troubles the application of a little oil of wintergreen will often suffice both to relieve the patient and give the doctor a key to diagnosis. And as the dose absorbed into the blood from a local application is generally small, this treatment may be used even in some of the cases in which there is organic disease sufficient to contraindicate the administration of salicylates on a larger scale. It has been shown that if a patient with acute arthritis is given a salicylate, it can be recovered from the fluid of the joint, whereas an iodid given to the same patient cannot be recovered.

Aspirin is used in the same dose as sodium salicylate. Many regard it as superior in action to the latter and claim that no toxic symptoms attend its use. It passes the stomach unchanged and the nascent salicylic acid is set free on reaching the alkaline intestinal juices. Later reports show that it possesses no advantages over the salicylates, and that toxic symptoms, such as gastric pain, nausea, giddiness, temporary deafness, and cutaneous rashes, may attend its use. There are some who contend that aspirin is of service in the differential diagnosis of gout and rheumatism; it relieves the pain of the former and is with less influence in the pain of the latter affection.*

ANTISEPTICS.

These are agents which prevent or inhibit the growth of micro-organisms. Therapeutic methods based on microbiology have been very effective in surgery, but internal antisepsis has only enjoyed a very limited amount of success. The reason is very evident. To be effective in arresting the growth of pathogenic organisms antiseptics would have to be introduced into the economy in such concentration that they would seriously impair the vitality of the tissues and kill by virtue of their own toxicity. In executing internal antisepsis our endeavor is now to augment the power of resistance of the tissues and their natural means of defense. We now know that in the blood-serum there are normally antiseptics which are antagonistic to micro-organisms, viz., agglutinins, bactericidal substances, bacteriolysins, and opsonins. In the present state of our knowledge the means best adapted for fighting bacterial infections is by means of bacterial vaccines which will increase the antibacterial properties of the blood.

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* Aspirin is applied to the tonsils in *follicular tonsillitis* by means of a probe wrapped with cotton, moistened with water and dipped into the drug. If decided relief is not obtained in twelve hours, the affection is not rheumatic and probably diphtheritic (Fetterolf).

*Gastro-intestinal Antisepsis.**—The alimentary canal seemed an alluring field for the use of antiseptics to control fermentation and putrefaction, but one must confess that our anticipations have not been realized. We have referred elsewhere to the many affections which unquestionably originate from gastro-intestinal auto-intoxication, and if we possessed a satisfactory therapeutic method of making the alimentary canal aseptic, we would have at our command a most valuable aid in diagnosis. Our conventional methods, such as evacuation of the alimentary canal and neutralization of the gastro-intestinal poisons, are merely temporary in their action. Some contend that intestinal antisepsis is impossible: (1) Because an antiseptic strong enough to destroy germs is equally destructive to the intestinal mucous membrane. (2) Germicides destroy the innocent germs which are concerned in digestion. (3) Germicides are rapidly absorbed or are made chemically inert. In my experience, intestinal asepticization is purely a theoretic conception, which is rarely realized in practice. Drastic purgatives hasten bacterial development by augmentation of the amount of liquid present (increased secretion and lessened absorption). If one were inclined to theorize, the proposition would be practically as follows: Intestinal sepsis is not measured by the quantity but by the quality of bacteria. The colon bacilli are present in abundance, and by destroying other bacteria, they protect the organism against pathogenic germs. Calomel is conceded to be an efficient intestinal antiseptic, yet more bacteria may be found after than before its administration. Another efficient antiseptic is naphthalen; yet Strassburger found that after its ingestion the bacteria were very much increased in number.

Intestinal auto-intoxication is more often a result of the development of toxic bodies from abnormal digestion, and perhaps quite independent of the action of saprophytic bacteria resident in the alimentary canal. Here intestinal antisepsis is best realized by promoting digestion and the general health, for with the body in a physiologic condition the organs of defense are quite capable of protecting the organism against auto-intoxication. The dried feces of a healthy man consist of one-third, by weight, of bacteria.

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*This subject is fully discussed in my recent books, "Self-Poisoning" and "Splanchnic Neurasthenia," second edition, 1906. E. B. Treat & Co., New York.

The upper part of the small intestine in fasting animals is practically free of bacteria. Bacterial growth in the intestine is inhibited by the hydrochloric acid from the stomach, the digestive fluids, and peristalsis, which inhibit the stagnation of food. In the large intestine the food moves more slowly, hence in this situation the bacteria have an opportunity to multiply. It is probable that the normal intestinal flora is necessary; at least, it inhibits the growth of pathogenic bacteria which have invaded the canal. ***Purgation*** is the usual method of treating intestinal self-poisoning. Purgatives, by increasing the blood-supply to the abdominal organs, often intensify the symptoms of self-poisoning (*vide* massage in diagnosis). Again, the removal of intestinal epithelium and mucus by purgation, which practically act as barriers against the absorption of the poisons, is certainly unfavorable. We have discarded the swab in infectious throat affections for the reason that it mechanically injures the membrane of the throat, and thus opens up new portals of infection. In this sense a purgative is practically an intestinal swab. Purgatives often intensify auto-poisoning. This result is not dependent wholly on the creation of new portals of entry for the poisons, but on concentration of the poisons which have already been absorbed into the blood. Retarded bowel action, as Strassburger[49] has shown, rather indicates diminished decomposition products which normally stimulate intestinal action. Based on the results of treatment, I am inclined to favor the view that many cases of intestinal auto-intoxication are due to augmented peristalsis of the upper intestinal canal. Here, the food is hurried away from the action of the intestinal juices so that it is insufficiently digested. To inhibit this increased peristalsis I give my patients a reliable preparation of *fluidextract of coto*, in doses of 10 to 15 drops after each meal. If constipation ensues, a mild laxative may be given at night. This treatment is worthy of trial in all cases of auto-intoxication. The feces eliminate from 5 to 9 per cent. of our excretions, as against 46 per cent. by the kidneys; although it has been shown that urea is normally found in the intestinal juice in small quantities, and that the intestine in part is an organ of excretion supplementary to the kidneys. If purgation must be used, then only those of the saline class (especially sodium phosphate) are indicated. Drastics must never be used. Aloes, colocynth, and cascara are not so useful as the salines, as the action of the former is limited to the lower portion of the colon, and self-poisoning, as a rule, arises in the small intestines. *Colonic impaction* demands high enemata of soap and water. MacCallum[50] has shown that the expulsion of saline enemata due to peristalsis caused by the salt can be prevented by the addition of calcium chlorid to the enema. A few drops of hydrogen peroxid introduced into the external auditory canal will loosen impacted cerumen and enable it to be removed more readily by syringing. On the same principle I have used rectal injections of the same drug for breaking up hardened fecal masses.

The double-current method of colonic irrigation permits of continuous irrigation and allows the small intestine to evacuate its contents into the lower bowel. Kemp's rectal irrigator is useful for this purpose, and in its absence the colon tube may be used. If an antiseptic is required, any of the following may be used: potassium permanganate (10 grains to the pint); formaldehyd, 1 minim of the 40 per cent. solution to every two ounces of the irrigating fluid; acetozone in 1:1000 solution. The *chlorosis* described by Clark would seem to correspond with the so-called septic anemia of Hunter, where the septic absorption is connected with pyorrhea, leukorrhea, but most frequently from the alimentary tract. Anemias from oral sepsis are usually caused by *pyorrhœa alveolaris*, and to detect the latter, dry the necks of the teeth gently and then press the gum over the root of the tooth, commencing at the apex and continuing to the neck. Thus pus, if present, is driven before the finger.

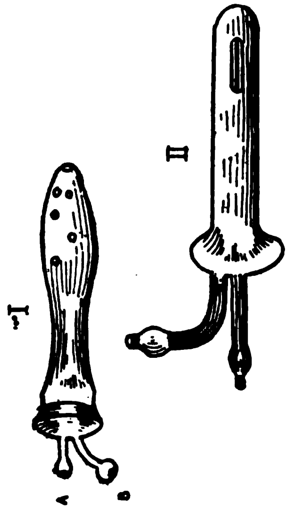

Fig. 25.—I, Bodenhamer's rectal irrigator: *A*, inflowing stream; *B*, outflowing stream; other apertures permit the escaping fluid to enter the irrigator. II, Kemp's rectal irrigator.

Forchheimer has noted Rigg's disease of the mouth as a frequent symptom in chronic intestinal auto-intoxication, as well as the presence of fecal matter (detected by palpation and percussion) in the sigmoid flexure and descending colon in practically all his cases.

The foregoing justifies the conclusion that intestinal antisepsis must commence at the buccal cavity.

Neutralization of the Gastro-intestinal Poisons.—Calomel is empirically regarded as one of our most efficient agents for this purpose. It is given in small doses, followed or combined with a mild laxative. It acts by unloading the bowels and by its action on the liver; an important function of the latter is to eliminate and destroy toxic substances. Small doses of calomel (1 grain) are more efficient than the large doses causing excessive purgation. To mention the agents which are supposed to neutralize the poisons would be to enumerate all the antiseptics. A valuable formula for securing intestinal antisepsis is the following:

Sodium glycocholate	1 grain
Sulphocarbolate of zinc	3 grains
Subnitrate of bismuth	6 grains

I usually give double the dose of the first two ingredients, and supplement the purgative action, if necessary, with three grains of cascara extract to each capsule. ***Bismuth*** is used in the formula, according to the suggestion of Croftan,[51] as an indicator of the presence or absence of sulphids (sulphuretted hydrogen or its salts) from the feces. H_2S and its alkali salts form black bismuth sulphid, and when the intestinal antiseptic is given in quantity sufficient to inhibit albumin putrefaction, then no bismuth sulphid is formed, and the stools are not colored black.

Dr. Heinrich Stern, in a personal communication, suggests the use of about 15 grains of basic bismuth subnitrate given with an Ewald test-breakfast. After the removal of the stomach contents, a black bismuth sulphid suggests the presence of hydrogen sulphid, which is formed in *gastrectasis*. This test is not convincing, for intestinal gases may invade the stomach when the pylorus is relaxed or while the chyme is passing into the duodenum.

Thymol.—Many recent writers make extensive use of this agent in instances of intestinal decomposition. Thus Kapp[823] affirms, based on a study of many cases of *acne*, that the urine of these patients shows a marked increase in the quantity of *indican*, which he attributes to intestinal decomposition, and that by the use of menthol (4 grains) and precipitated sulphur (15 grains), two or three times daily, excellent results are achieved.

Bacteriotherapeutic Methods.—These methods for controlling intestinal auto-intoxication are quite popular in France, and consist in introducing antagonistic microbes to combat proteid putrefaction in the intestines. The chief characteristic of the intestinal flora of the auto-intoxicated is the marked diminution of the saccharolytic aërobic bacilli and the preponderance of proteolytic anaërobic varieties. To modify the foregoing condition, a vegetarian or lactovegetarian diet is indicated on account of the small quantity of proteid matter which it contains and the lactic acid which it produces. Still another method, and one commonly employed, is to feed the subject with lactic acid ferments or microbes which are innocuous but exert an inhibitory action on the microbes of putrefaction. At present there are three lactic culture-mediums on the market: (1) liquid lacto-bacilline of Metchnikoff; (2) biolactyle of Fournier, and (3) the paralactic bouillon of Tissier. The most convenient way of giving the pure culture of the lacto-bacilline is in glutenized globules, insomuch as the ferment is only liberated in the intestine, but it has been shown by Combe and his pupils[52] that the globules seem devoid of all action, due perhaps to some destruction of their properties during the preparation. Combe finds that liquid lacto-bacilline is the most efficient of all preparations, and it is prepared for consumption in the form of Yoghourt by mixing lacto-bacilline with milk. During the first few days of treatment, digestive disorders are experienced, but soon constipation ceases, the stools lose their putrid odor, the breath sweetens, and the tongue becomes cleaner. The signs of auto-intoxication disappear slowly and surely. To make these good results permanent, the treatment is continued on an average for two and one-half months. The diet consists largely of fruits and vegetables, although some writers claim that nearly all the effects can be secured from the ferment alone. The liquid lacto-bacilline may be taken as such, one tube a day. According to Cohendy, it takes about six days before the lactic acid microbes change the intestinal flora. If diarrhea is caused by intestinal putrefaction, it is arrested by this bacteriotherapeutic method. If lactic acid culture-mediums cannot be obtained, then buttermilk, condensed buttermilk, or koumyss may be used. The relatively small quantity of fat and casein in buttermilk makes it a suitable food in intestinal auto-intoxication, insomuch as one knows that these substances favor intestinal putrefaction. The lactic acid, but chiefly the lactose, which it contains enables it to produce lactic acid *in statu nascenti.* Lactone or buttermilk tablets, which represent in compressed form a pure culture of lactic acid bacilli, are now sold for the extemporaneous preparation of buttermilk. The tablets in question keep the cream in the milk, thus making it of greater nutritive value and, unlike the ordinary buttermilk, the number of putrefactive bacteria is less.

If *rheumatoid arthritis* is of intestinal origin, due to the absorption of toxins, the employment of fermented milk seems to exert a powerful influence on the arthritic processes. Holt suggests the following formula for the domestic manufacture of koumyss: One quart of fresh milk, ½ oz. of sugar, 2 oz. of water, and a fresh piece of yeast cake, ½ inch square, are put in wired bottles and kept at a temperature between 60° and 70° F. for one week; the bottles are shaken five or six times a day. They are then put upon the ice and kept ready for use.

Creosote.—Creosote vapor baths are of undoubted value in preventing the decomposition and diminishing the quantity of the bronchial secretion in *bronchiectasis.* A small room cleared of all unnecessary furniture is used for the bath. To prevent the odor of creosote penetrating the clothing, an overgarment is worn. Goggles protect the eyes and cotton is inserted in the nostrils. Commercial creosote is poured into a metal vessel resting on an iron tripod and the vessel heated with a spirit-lamp. As the creosote is heated, dense clouds of vapor rise and fill the room. The effect is to produce violent cough, attended with much expectoration. I also use the bath in suspected cases of *phthisis* when I can obtain no sputum for examination.

Dermatol.—This is bismuth subgallate. Simionescu[53] employs this drug for diagnostic purposes in *ear suppurations.* When the powder comes into contact with the bacilli of putrefaction, it forms a black paste. The bacilli in question in effecting proteolytic decomposition produce sulphuretted hydrogen, which unites with the bismuth of the dermatol to form the black bismuth sulphid. If such proteolytic bacilli are absent, no matter what other kind of organisms may be present, the dermatol preserves its yellow color.

Helmitol.—This drug, the dose of which is 15 grains, although larger doses may be used, is an excellent disinfectant for the urinary passages and imparts an acid reaction to the urine. In suspected infections of the bladder or kidneys it may be tried to determine whether existing symptoms are provoked by infection. It is an excellent remedy in *phosphaturia*. The presence of phosphates in the urine provokes much mental suffering in many patients, and if one can cause the phosphates to disappear, the mental symptoms are correspondingly influenced. In the so-called *phosphatic diabetes*, aside from increase in the excretion of phosphates, polyuria, thirst, and emaciation may be present. The patients are very nervous, and sugar may be present or it may only appear later in the affection. The chief point in diagnosis is that the phosphates must deposit in the urine spontaneously (equal to one-quarter or one-half of the bulk of the fluid), without the aid of heat, alkalies, or the addition of any reagent. This drug can also be used to advantage as a prophylactic in the infectious fevers following urethral instrumentation. **Urotropin** (dose, 5 to 15 grains) is also an efficient urinary disinfectant, but not if the urine is alkaline, for in the latter condition urotropin will be excreted unchanged, and cannot therefore exercise its disinfectant properties. Recent experiments of Crowe[387] show that after the administration of urotropin (15 grains) by the mouth it was excreted both in the bile and pancreatic juice, hence the remedy may be employed in gall-bladder infections, to note whether pyrexia and other manifestations supposedly due to the latter are in any way influenced. Seventy-five grains of the drug are necessary in twenty-four hours to destroy the infecting organisms.

Perhydrol.—This is Merck's acid-free peroxid of hydrogen. This or a dilute solution of hydrogen peroxid has been used by Alexander[54] for the diagnosis of *gonorrhea*. He makes a urethral injection with the solution, and the violent evolution of oxygen arising from the blood and pus present forces the gonococci from obscure hiding-places to the meatus, where they may be obtained for microscopic examination. The method is available in the diagnosis of chronic and incipient gonorrhea. It also enables one to say .whether a gonorrhea is cured, and is better than the old method of having the patient drink beer, or by the use of silver nitrate. With the latter an artificial urethritis is created, and search is then made in the pus for gonococci. To stimulate the urethral secretion when scanty, as an aid in searching for gonococci, irritating irrigations of the entire urethra are also made with a 1: 10,000 bichlorid solution or 1:5000 silver nitrate solution. Another method is to have the patient drink beer or champagne the evening before the examination.

In operating for the closure of a *fecal fistula* the aperture in the bowel is often found with difficulty, because the field of operation is obscured by blood or a network of adhesions. Royster[66] suggests an ingenious method for locating such fistulas by injecting hydrogen dioxid through the anus, the effervescence demonstrating the site of the aperture. This method would appear to be equally efficacious in locating the openings of other fistulas.

The addition of hydrogen dioxid to the *sputum* is recommended by Peters as a simple and effectual method of breaking up viscid masses and facilitating an even distribution of tubercle bacilli through the sputum.

Nevi dependent solely on pigmentation have been eradicated by repeatedly bathing them with a 30 per cent. solution of hydrogen peroxid.

The rapid removal of *cerumen* from the external auditory canal may be facilitated for purposes of diagnosis by introducing hydrogen peroxid into the canal and then washing. Ether (6 or 8 drops) may be poured into the ear for the same purpose preliminary to syringing. At the end of a minute the softened wax is easily removed by the syringe (Badcock). The presence of cerumen should always be determined before dropping in the ether, as it may cause pain if it falls directly on the tympanic membrane. Patients must always be informed that the hydrogen peroxid may diminish audition temporarily.

Headaches are often caused in old cases of chronic suppuration of the ear in which masses of indurated products form in the cavities of the middle ear and mastoid. The pain is dull and heavy and becomes more pronounced when injections of hydrogen peroxid are made, which, by causing the masses to swell, increase the pressure.

It is important to know that peroxid of hydrogen softens and loosens the dressings of wounds.

Peroxid of hydrogen decomposes *pus*, as is evidenced by the frothing when the solution comes into contact with the pus; hence cessation of effervescence indicates that pus is no longer present. For diagnosis of empyema of the antrum hydrogen peroxid solution (1 to 12 of water), injected through the ostium, will drive out the pus if present and fill the nose as a white foam (Brown). In all suppurative affections the extent of the suppuration may be determined from the amount of effervescence. If, as is asserted, normal mucous membranes decompose hydrogen dioxid with the liberation of nascent oxygen, the diagnostic value of the drug in question is doubtful.

Salol.—This drug resists the action of the gastric juice and is only broken up by the alkaline intestinal fluids into salicylic acid (60 parts) and carbolic acid (40 parts). The dose is 5 to 20 grains. When we wish to administer drugs by the mouth and avoid gastric irritation or when it is desirable to concentrate the action of drugs, like purgatives or antiseptics, on the bowels, pills coated with a salol varnish may be used. The varnish is composed of: salol 2, shellac 3, and absolute alcohol and ether, of each, 3 parts. Varnish several times until the layer is sufficiently thick.

To test the *motor power of the stomach*, the patient is directed to take 1 gram of salol in one or two capsules after a meal. At intervals of one-half hour, one hour, two hours, and twenty-four hours afterward, the patient is directed to urinate, preserving each specimen in a separate vessel. Each specimen is then tested for salicyluric acid by adding to the urine a few drops of a solution of sesquichlorid of iron, which yields a violet color in the presence of the acid. The salol is only broken up in the intestines, hence the reaction shows that the drug has passed the stomach. The reaction appears normally in about one hour. A delayed reaction indicates deficient motor power, and in stenosis of the plyorus the reaction may not appear for twenty-four hours. This salol test is not absolutely reliable for determining motor insufficiency. The salol capsule may pass out of the stomach with the first portion of food, or later on, depending on the uniform mixture of the capsule and the stomach contents; and, again, the splitting up, absorption, and elimination of salol cannot be governed by fixed rules. Generally speaking, however, the method is fairly reliable.

As a test for *pancreatic activity*, salol (60 grains) is given in cachets in divided doses during twenty-four hours, and the urine is examined as above for salicyluric acid. The test depends, as suggested, on the fact that salol is only broken up in the presence of the alkaline pancreatic juice, which, when absent, will not produce the reaction in the urine of salicyluric acid or carbolic acid.

ANTITOXINS.

Immunity.—Brief reference will be made to the chemical defenses of the organism. Immunity is usually conferred on the individual against the same infectious disease after recovery therefrom. Vaccination is a protective inoculation secured by the virus of smallpox mitigated by passing through the body of a calf. We practise curative inoculation when antitoxins are employed. In the blood are certain bactericidal proteid substances known as bacteriolysins. The blood has also a globulicidal power. Thus the blood-serum of one animal when injected into an animal of another species will destroy the red corpuscles, causing hemoglobinuria. The substances possessing the latter property are known as hemolysins.

The bactericidal power of the blood is increased when the blood is made more alkaline. Thus venous blood, which contains more diffusible alkali, is more destructive to bacteria than arterial blood. In diabetes the alkalinity of the blood is reduced, hence the diabetic is more susceptible to infectious diseases. The susceptibility to infection is merely a question of individual resistance, and is dependent on the quantity and quality of the bacteriolysins. Every bacterium causes the development of a specific bacteriolysin. By inoculating an animal with a specific toxin an antitoxin is developed which is present in the serum of the animal, and the latter is employed for curative inoculation. Ricin and abrin are poisonous proteids obtained respectively from castor-oil seeds and the jequirity bean, and when given to animals, immunity is secured by the production of antiricin and antiabrin. In the side-chain theory of immunity as expressed by Ehrlich, toxins possessing groups of atoms corresponding with the protoplasm of living cells unite with the latter, just as do the nutrition proteids in normal assimilation. Toxins of this atomicity belong to the haptophore groups, and the groups to which they become attached in the cells are known as the receptor groups. The toxin is supposed to stimulate the receptors to excessive production, and the latter present in the circulation constitute the antitoxin. Another protective property of the blood is its power, by means of agglutinins, of causing bacteria to become immobile and clumping together, and is illustrated in the *agglutination test.*

Diphtheria Antitoxin.—This is obtained from the serum of horses which have been immunized by the injection of the toxin of diphtheria obtained from cultures of the bacillus diphtheriæ. The strength of the antitoxin is measured in units, and a unit is the amount of antitoxin necessary to save the life of a guinea-pig which has received 100 fatal doses of toxin. Above all things, we must remember that this antitoxin is practically innocuous, and the slight untoward effects have been noted elsewhere. Bearing this fact in mind, more cases can be saved by its early use with larger doses than are ordinarily employed. In a suspected case of diphtheria it seems almost criminal to wait for the report of the bacteriologist before using the antitoxin. Many diphtheroid inflammations are really cases of diphtheria due to the Klebs-Löffler bacillus, and the number of such cases of pseudo-diphtheria is rapidly diminishing, thanks to more thorough bacteriologic examinations. The amount of antitoxin necessary can only be gaged by its effects: viz., contraction and exfoliation of the membrane, diminution of the amount and fetid odor of the nasal secretions, relief of the stenosis in laryngeal implication, and improvement in the general condition. The danger always lies not in using too much, but in the employment of too little of the antitoxin. Age does not determine dosage, hence no special allowance must be made for children. According to the foregoing reaction to be achieved, the dose necessary may only be 5000 units or it may be 80,000 units. If no reaction results from the first dose of 10,000 units, it may be repeated in several hours. The foregoing reaction in the throat will assist in the differentiation of diphtheria from diphtheroid inflammations. Care must always be exercised in obtaining a fresh and reliable preparation of antitoxin. Schick has found that *cutaneous inoculation* with a concentrated solution of diphtheria toxin will cause a papule to appear at the point of inoculation within eight hours, and in twenty-four hours it will be surrounded by a red areola. The reaction does not occur if the patient has been previously immunized with diphtheria antitoxin. A positive reaction shows that the body is deficient in antitoxic substances.

The oral and rectal routes have been suggested in lieu of the hypodermatic use of the antitoxin. Such heterodoxic employment is, to say the least, a venturesome procedure. McClintock and King[55] have recently found that the oral administration cannot be relied upon to produce results corresponding in value to the hypodermatic use. It is evident that the digestive fluids act deleteriously on the antitoxin. When the antitoxin is given on the first day of the disease, the mortality is practically *nil*, and the longer the delay in its use, the greater the mortality, which on the fourth day exceeds 20 per cent.

Post-diphtheritic complications are amenable to antitoxin even though it was not employed in the primary disease, but the dose must be large and frequently repeated.

Immunization following the prophylactic use of diphtheria antitoxin lasts from three to five weeks, provided the subjects are removed from infectious surroundings (Stiller).

Deardorff recommends diphtheria antitoxin as a specific in *pertussis*, and that a full dose must be given. It has been suggested that the *collapse* following an antitoxin injection is caused by direct entrance of the injection into the blood stream. The latter may be avoided if aspiration is executed before injecting: blood in the syringe would indicate that the needle entered a vein. Another way of noting the effects of the antitoxin would be to give a preliminary small dose, and if the patient shows no decided reaction, the usual dose can be given a few hours later.

Leprolin is a serum obtained from cultures of leprosy bacilli. According to Rost,[56] the effects of injections are strikingly rapid, and consist in the disappearance of the anesthetic areas and restoration of the normal pigmentation of the skin. A reaction like the foregoing would prove of inestimable value in the differential diagnosis of many skin and nervous diseases, but unfortunately recent experiments have yielded negative results. Rost injected 160 minims of the serum at intervals of a few days up to about two weeks, according to the intensity of the reaction. No undesirable sequelæ have been encountered.

Mallein.—There is a disease of the horse known as *glanders* (farcy), due to the bacillus mallei, which is transmitted to man by accidental inoculation. Stablemen, grooms, and hostlers are especially liable to inoculation. In acute glanders the nodules in the nasal mucosa break down, producing ulcers with a mucopurulent discharge. The nose is very much swollen. A papulopustular eruption may be present, and has been mistaken for variola. Chronic glanders is usually mistaken for chronic coryza, and the affection may last for months. When the skin is involved, there are subcutaneous nodules which suppurate. The diagnosis of the affection can be made by injecting a suspension of the secretion into the peritoneal cavity of a male guinea-pig. In two days, if the bacillus mallei is present, the testes swell, and later suppurate. An indirect diagnosis may be made by using the *mallein test.* A dose of 1 c.c. of mallein is injected into the sick horse in the neck over the vertebræ midway between the jaw and shoulder; the reaction is a temperature rise of 2.7° F. after twelve to twenty hours, and an extensive hot and painful swelling. Prostration, shivering, and other constitutional disturbances may ensue. The reaction is not reliable if the temperature at the time of inoculation is 2.5° F. above normal. In the latter instance the occurrence of the local swelling will be the only guide.

Opsonins.—The determination of the opsonic index is an important aid in diagnosis, for the amount of opsonins present in the blood of a given person determines his susceptibility to bacterial invasion. It enables one to say whether the bacterial process is localized, *i. e.*, whether it is not in free communication with the lymph and blood circulations, or whether such communication exists. It is very important to know, in diagnosis and prognosis, whether a septic process is local or systemic, or whether sufficient immunizing products exist in the blood to guard against systemic infection. The treatment of bacterial infection is governed by the following principles, formulated by Wright and Douglas: (1) Isolate in pure cultures the causative micro-organism. (2) Determine the opsonic power of the patient's blood to the micro-organism. (3) If the opsonic index be at or below normal, prepare and standardize a vaccine from this microorganism. (4) Inoculate the patient with this vaccine with appropriate doses and at proper intervals, as shown by a systematic estimation of the opsonic content of the patient's blood. The technic of obtaining the opsonic index and the preparation of vaccines are methods which at present require some bacteriologic skill, but there is no doubt that the latter will be sufficiently simplified for employment by the average physician. However, when the question of diagnosis arises on points previously indicated, the aid of a bacteriologist should be sought. Sir A. E. Wright has shown that the phagocytes defend the organism, owing to the action of substances (opsonins) in the blood-serum which endow the phagocytes with the property of taking up the bacteria.

Technic.—To determine a patient's opsonic index we require: (1) Normal serum for control; (2) patient's serum; (3) washed blood-corpuscles; (4) bacterial emulsion.

A venous congestion is produced in a finger by means of a piece of bandage wrapped around it. The pointed end (A) of the glass capsule (Fig. 26) is used to prick the finger near the root of the nail, and, both closed ends having been broken off, the blood is drawn up through the short limb (*a*). The straight end is again sealed with the flame, and the rarefied air contracting, leaving the end (*a*) free, this also can be sealed with the flame or with wax. The blood is allowed to clot, and to obtain a good amount of serum, the tube is suspended by its bent limb into the tube of a centrifuge and centrifuged. The serum is then removed with the long capillary tube (B) after snapping off the bent limbs of the glass capsule. To obtain the corpuscles a few drops of blood are received into a small glass tube two-thirds filled with a freshly prepared 1.5 per cent. solution of sodium citrate. The blood is well mixed and the tube centrifuged until the corpuscles settle. The clear fluid is pipeted off, and the corpuscles mixed with enough 0.85 per cent. salt solution to fill the tube as before. After again centrifuging and removing the supernatant fluid, the corpuscles are mixed, and are now ready for use. These corpuscles must be prepared daily, and the worker usually furnishes his own; though the origin of these corpuscles makes no difference. The making of the emulsion varies with the organism used. In tuberculosis

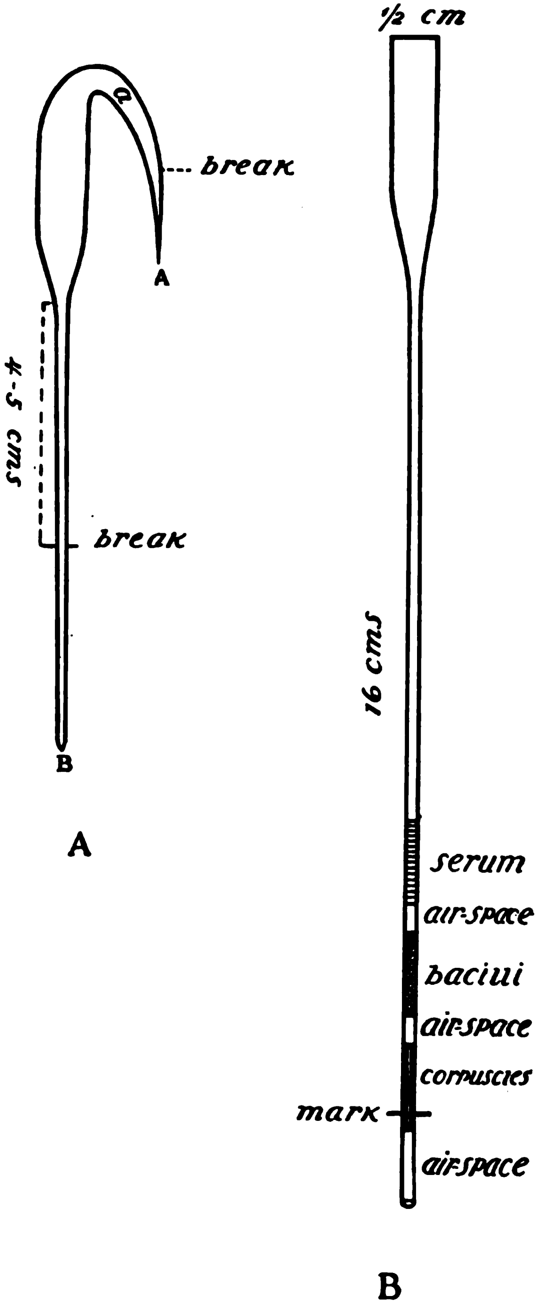

Fig. 26.—Capillary tubes for obtaining the opsonic index.

it is easier to use the dead, dry bacilli, such as can be had of Meister, Lucius, and Brunning. A small amount of this product is ground up in an agate mortar, first alone until finely powdered, then adding very slowly, drop by drop, a 1.5 per cent. salt solution until first a paste and then an emulsion are made. Great care is required in all this to avoid, as far as possible, the presence of clumps. The emulsion is then sterilized in a water-bath (60° C.) for one hour. The emulsion can be kept but a short while; it should always be examined for clumps before use. If the latter are present, centrifuging is necessary. If not enough bacilli have remained in suspension, a new emulsion must be made.

For making emulsions of other bacteria a platinum loopful of the growth from a live agar culture is diluted with 0.85 per cent. salt, and emulsified by drawing it up and down a strong pipet. One volume of washed corpuscles, one of serum, and one of the bacterial emulsion are drawn up into a pipet and then blown out and thoroughly mixed on a clean slide; then drawn up into the pipet again and the end sealed in the flame. This is then placed in an incubator at a temperature of 37.5° C. After twenty to thirty minutes the pipet is removed from the incubator, the end cut off, and the contents used for examination. A drop is received upon one end of a slide, previously roughened by rubbing with emery-paper, and the smear made by means of a slide so broken as to give a barely visible concave edge, this bringing all the white corpuscles to the very edge, where they are easily counted. Smears are fixed in a saturated sublimate solution (two or three minutes suffice). For tubercle bacilli the Ziehl-Neelsen stain is used, whereas other stains are employed for other organisms. At least one hundred leukocytes are counted. A good emulsion will have given no clumps, and should have been so dilute as to give an average to each leukocyte of two to four tubercle bacilli; if cocci, three to eight. The average number of bacteria ingested by one white blood-corpuscle is the phagocytic index (P. I.). The patient's P. I. divided by the normal P. I. gives the patient's opsonic index. Thus, the average number of bacteria ingested by one white corpuscle tested with normal serum, 5; tested with patient's serum, 3; patient's opsonic index = 0.60.

The technic must be accurately carried out in every detail if the results are to be of any value. The slightest deviation (*e. g.*, using a too thick or too dilute emulsion, carelessly washed corpuscles, variable temperatures, and duration of incubation, counting less than one hundred corpuscles) is sure to make the results unreliable.

Diagnosis.—Taking one normal serum as the standard and assuming for it an opsonic index of 1, it has been found that only those persons the subject of disease due to the bacteria used for the test show deviations from the normal. Moreover, opsonins are apparently specific. A tuberculous patient with an abnormal index for tubercle bacilli may have normal indices with all other bacteria. This serves as a means of determining the character of the infection when all other methods of diagnosis fail. A constant low index with the bacillus of tuberculosis speaks either for a lowered resistance to the germ or the presence of the disease. A constant high index speaks for repeated inoculations of tuberculous products, stimulating the production of opsonins. A fluctuating index is a sign of repeated overstimulation with tuberculous products, with the production of a succession of irregular positive and negative phases of immunity. Low indices are often encountered in localized infections; fluctuating indices in active lesions, *e. g.*, pulmonary; high indices are seen in convalescents or cured tuberculosis. Moreover, at times a tuberculous serum, heated to 60° C. for ten minutes, still promotes phagocytosis, whereas normal serum does not. This is, when positive, a very reliable test. If a patient with tuberculosis is made to exercise, diagnostic changes in the index may be noted in what would have been an otherwise normal curve had the patient been kept at rest. The application of this is frequently valuable, considering the justified cautiousness in using tuberculin to decide as to the nature of doubtful exudates, cutaneous or visceral lesions. Much, of Hamburg, has used the O. I. in the diagnosis of cases of typhoid, paratyphoid, and colon infections, and has found it reliable even at a time when other confirmation was still absent, *e. g.*, blood cultures and agglutination tests. In puerperal sepsis he has found it of equal value. On the other hand, Rolly, of Leipzig, has worked extensively on the same subject, and attaches practically no value to the index in diagnosis. It is to be hoped that further work will confirm the work of Much, the importance of which cannot be overestimated.

The O. I. furthermore serves as a means of controlling therapeutic inoculations with bacterial vaccines, for though careful clinical control may at times suffice, it may also at times be very dangerous to rely upon it alone in deciding upon the dosage of the inoculations. However, personal experience has shown that when one finds a fluctuating index, the results of so-called auto-inoculations, tuberculin is of practically no therapeutic value if one depends upon the index to measure improvement of the lesion. Wright has shown that injections of dead bacterial cultures (one hour at 60° C.) produce, if properly dosed, first a slight depression (negative phase) and then a distinct rise (positive phase) of the opsonic index, and, according to his theory, a corresponding increased resistance to that particular bacterium. Clinical results seem to confirm this theory, though no other proof can be brought forward as yet.

By means of his vaccines, the size and frequency of injections being controlled by a study of the opsonic curve, Wright and his followers have obtained excellent results in infections due to the staphylococcus, proteus, gonococcus, pneumococcus, and colon bacillus. Especially in staphylococcic infections has the efficacy of the vaccine treatment been marked. In cases of acne, postoperative fistulas, and furunculosis, success has followed the vaccine injections, after unsuccessful trials of all other known methods of treatment. Vaccines have been employed with decided benefit in different forms of infection, notably in gonorrheal arthritis, otitis (from scarlatina), empyema, etc. Bacterial vaccines (staphylo- and streptococcus and gonococcus) are now purchasable from the manufacturing chemists.

Streptococcus Serum.—A large number of cases of chronic *rheumatism* may be traced to some infectious origin. Mumps, typhoid fever, pneumonia, influenza, etc., may have preceded the articular affection. In such instances the salicylates are comparatively inert and streptococcus serum should be tried. Menzer's serum appears to enjoy the most favor. Merck furnishes a normal serum, 1 c.c. of which is injected subcutaneously, and in chronic streptococcus infections a local and general reaction ensues.

Relief is secured, according to Menzer, in all cases of chronic rheumatism when there are no adhesions, but in the presence of the latter and in acute rheumatism, pain and inflammatory reaction follow the use of the serum. In chronic articular rheumatism Menzer's streptococcus serum is employed in doses of 5 c.c., injected every other day up to a total dose of 50 to 100 c.c. The serum is said to be innocuous. It seems to be very effective, even in articular rheumatism which has resisted the salicylates, and nearly all concede that it is ineffective in protracted infectious diseases (pyemia and septicemia) and in the presence of abscesses and purulent exudates.

In carrying out the antiseptic treatment in *pernicious anemia*, William Hunter assumes that when intestinal antisepsis is ineffective, the poisons have been absorbed in the blood, and **anti-streptococcic serum** is indicated. The latter he has found diagnostic as well as curative. Thus, in one case where the blood-corpuscles had remained about 20 per cent. for over two months, they rose to over 60 per cent. in seven days, and to 80 per cent. in three weeks, when the woman was discharged as cured. One must begin with small doses of the serum (5 c.c.).

In gonorrheal arthritis the **anti-gonococcus serum** may be tried as a diagnostic and curative method. It is more effectual in recent than in old cases. Eugene Fuller attributes this form of arthritis to a gonorrheal vesiculitis, and the immediate good result achieved by opening and draining the vesicles is excellent evidence in favor of his theory. The antiserum of Tarrey has also been used successfully in gonorrheal arthritis.

Deutchmann's Serum.—This is a serum obtained from horses which have been fed with increasing doses of sterile yeast. It is used in all kinds of infections and seems to neutralize staphylococcic, streptococcic, or pneumococcic infections; in other words, it does not act on any particular kind of germ, but on all germs. In acute febrile infections the temperature falls gradually but continuously, and in six to twelve hours reaches the lowest point. The serum is well borne (untoward symptoms are itching, erythema, and urticaria) and the dose varies from 0.75 to 1 c.c. in young subjects to from 2 to 4 c.c. in adults. The initial dose should be the larger one, and is to be repeated on the next day if the temperature does not drop. In chronic cases one injection (0.5 to 4 c.c.) is given and repeated, according to the results, two or three times a week.

Flexner's Antimeningitis Serum.—This antiserum is injected into the cerebrospinal canal according to the technic of Flexner,[381] and the first injection is usually followed by a permanent fall of temperature to the normal. Some observers contend that in its action its diagnostic and therapeutic value is comparable to that of diphtheria antitoxin in diphtheria. Ruppel's *meningococcus serum* diagnosticates true meningococci by agglutination in dilutions of 1:500 to 1:1000. The same serum as a powder is used as a prophylactic in cerebrospinal meningitis by being blown into the nasopharyngeal space and on the tonsils. This serum is also employed for curative purposes subcutaneously and into the spinal canal.

Hemolytic Action of Blood Serum.—If a small amount of blood serum is taken from a patient suffering with malignant disease and added to a suspension of red blood-cells in salt solution, hemolysis occurs. This is not the case with serum obtained from normal individuals. Unfortunately, the action cannot be regarded as specific, for it is obtained in tuberculosis, diabetes, and cardiac disease.

Serum Diagnosis of Syphilis.—From the mass of evidence thus far adduced, the serum diagnosis of syphilis seems an assured fact. The diagnosis is a complicated one and should be intrusted to experts. It is positive in from 90 to 95 per cent. of all cases with syphilitic symptoms and in about 55 per cent. of latent cases of the disease. In parasyphilitic affections the reaction is obtainable in about 75 per cent. of the cases. When a positive reaction is elicited, it indicates the necessity for specific treatment. In syphilophobia this test is of great value. The reaction of Klausner, referred to elsewhere in this book, is not found to be peculiar to syphilis, but is dependent on the precipitation of globulin, which is augmented in all infectious diseases.

Tuberculin (Koch's Original or Old).—This is an amber-colored fluid which consists of a boiled and concentrated glycerin-broth culture of tubercle bacilli, the latter having been removed by filtering.

Tuberculin is employed as a diagnostic expedient in all doubtful cases of diagnosis. One minim of the tuberculin is mixed with 1 ounce of a ½ per cent. carbolic acid solution. Ten drops of this solution is equivalent to $\frac{1}{10}$ of 1 milligram of tuberculin, and may be injected anywhere. A fresh solution may thus be made in making the test.

Prior to its use the average temperature of the patient is determined for several days, after which ½ or 1 milligram is injected hypodermatically. A rise of temperature up to 2° F. is regarded as positive evidence of tuberculosis. If no temperature elevation follows, then a second injection, after an interval of three days, of twice the primary dose, is made. If there is still no reaction (rise of temperature), after waiting four days a final injection of 4 or 5 milligrams is given. If tuberculosis exists, a reaction usually follows the first injection within ten or twelve hours, and may reach 104° F. Other evidences of reaction noted are: increase of dullness in the infiltrated lung area with râles (accentuated if previously present), cough, and expectoration.

In peripheral tuberculosis of the skin and elsewhere there is a local reaction which is of undoubted diagnostic value, viz., intense hyperemia with leukocytic invasion of the affected area, and if ulceration is present, there is an augmented destruction of the ulcerated parts. In joint tuberculosis the skin over the joint becomes red. Changes can be noted directly in a tuberculous mouth ulcer, with the laryngoscope in lesions of the larynx, and with the cystoscope in like lesions of the bladder. Even in the absence of a cystoscope, the accentuation of the bladder symptoms following the use of tuberculin may suggest a tuberculous lesion. When a tuberculin injection is made, an intense redness and swelling are observed to follow at the site of puncture, which may persist for several days. This *puncture-reaction* is regarded by several observers as a specific reaction in tuberculosis.

Renal Tuberculosis.—The presence of tubercle bacilli in the urine is diagnostic of this condition, but their absence does not disprove it. Even the urinary sediment in which no bacilli are found may develop tuberculosis in a guinea-pig when injected into the latter. Czerny has demonstrated that in tuberculosis of the kidney in which no bacilli are found in the urine, injections of tuberculin will cause large numbers to appear, and at the same time one obtains the tuberculin reaction. According to Rovsing, the demonstration of tubercle bacilli succeeds only if the reaction of the urine is not ammoniacal, because the latter interferes with the staining of the bacilli. The bacilli can be stained if the alkaline reaction of the urine is changed into an acid reaction by the internal administration of boric acid (5 to 20 grains, three times a day). When no tubercle bacilli can be demonstrated in the sediment, Damsch inoculates some of the sediment into the anterior chamber of the eye of a rabbit. If nodules appear in the iris in the third week, the tuberculous character of the urogenital affection has been demonstrated. Inoculation of a guinea-pig is usually made under the skin of the groin, after carefully washing and shaving the area to be punctured with the hypodermatic syringe. If the reaction is positive, distinct nodules can be palpated in the enlarged inguinal glands two or three weeks later, and when the animal is killed, the tubercular glands are readily recognized. A rapid test (nine days) fot determining the presence of tubercle bacilli in the urine is to inject the washed sediment subcutaneously into the thigh of a guinea-pig, and the inguinal glands of the same side are crushed at the same time with the fingers. If the bacilli are present in the sediment, they may be found in large numbers in the excised glands after nine days (Bloch). Intolerance of silver nitrate is a valuable sign in tuberculosis of the bladder.

Such competent authorities as Trudeau and Osler, who have used the tuberculin test extensively, testify to its harmlessness. The latter has gained valuable information from the test in obscure internal lesions, joint cases, and in suspected renal tuberculosis. Others contend that deaths have resulted from its use in cardiac failure, that it exaggerates the symptoms of an existing nephritis, that dyspnea is increased in laryngeal tuberculosis, and that there may be an extension of the lung affection. Cases of acute miliary tuberculosis have been reported to follow the test. In all questions of this kind there are optimists and pessimists, the representatives of extreme views. Tuberculin is not innocuous, nor is it the baneful preparation which the pessimist makes us think it is, but it must always be employed with discretion. The injection should not be used unless the temperature record for several days shows the absence of fever. The injection should be made at a time when the temperature can be systematically taken, hence the injection should be made during the day. Following the injection, the patient should remain in bed. Now, as to the value of the test. As an early evidence of pulmonary tuberculosis, personally, I regard the test as a gross one, and a mere apology for lack of skill in physical diagnosis. If the tuberculin test is positive, one has merely established a late diagnosis of phthisis, equally as tardy as the presence of tubercle bacilli in the sputum, and, to recall a trite German aphorism: "*Jedermann hat am Ende ein Bischen Tuberkulose.*" It is true that many of us are tuberculous, and that our lesions are not in communication with the bronchial tree, for otherwise tubercle bacilli would be present in the sputum. Ninety-six per cent. of the cadavers of adults show tuberculous lesions. Syphilitics, as Otis, of Boston, has shown, may react to tuberculin, and in actinomycosis a similar reaction may be obtained. There are patients who fail to react even to maximum doses of tuberculin and who later develop tuberculosis, and, again, some phthisical subjects (especially diabetics) give no reaction. It has been shown that *saline injections* may cause an elevation of temperature in latent tuberculosis, but it is not sufficiently constant to be of positive diagnostic value. Rotch and Floyd[318] contend that the use of tuberculin in the diagnosis of tuberculosis in children is without danger and of great value when properly used. Their method is as follows:

The solution for using this test is prepared as follows: One cubic centimeter of Koch's old tuberculin is added to 999 c.c. of boiled distilled water—1 c.c. of this solution equals one milligram. The dose of this solution for an infant or young child is from 2 to 5 milligrams, according to the age. In using this test a record of the child's temperature must first be kept every two hours for twenty-four hours. If it is then found that the temperature is irregular or high, the test is not of much value. If, however, the temperature is regular and not over 37.7° C. (100° F.), the test can be used. After the part of the skin to be injected has been thoroughly washed, first with soap and water and then with alcohol, and the hands of the operator and the syringe disinfected, the injection is made. If the child is not tuberculous, no symptoms will be noticed, unless occasionally in certain cases of syphilis. If it is tuberculous, the temperature will rise in from eight to twenty-four hours after the injection and will fall again within about twenty-four hours. During the period of reaction there may be a certain amount of malaise, but there is little or no danger of serious results. A positive reaction will be obtained in about 95 per cent. of cases of tuberculosis. A negative reaction does not positively exclude tuberculosis, although it is a very strong evidence against it. By giving a small dose, repeated with intervals of three days, the reaction will be less violent, and any possible danger of an excessive dose will be reduced. In cattle the tuberculin test is extremely valuable. Healthy animals show no reaction, but in animals that are tuberculous there is a rise of 1½° to 6° F. after the injection.

Moeller, with his large experience, formulates the following rules (1905) for the use of tuberculin in the diagnosis of tuberculosis, after noting contraindications for its employment, such as fever, hysteria, recent hemoptysis, and epilepsy. The object is to use it with as little risk and reaction as possible. He begins usually with 0.1 to 0.2 milligram, obtaining this quantity by dilution as follows:

(A)	1 c.c. tuberculin	+	9.0 c.c.	of	0.5%	carbolic	acid,	1 c.c.=0.01 gram	tuberculin
(B)	1 c.c. of A dilution	+	9. c.c.	"	"	"	"	1 c.c.=0.001 gram (1 mgram.)	"
(C)	1 c.c. of B	+	9. c.c.	"	"	"	"	1 c.c.=0.1 mgram.	"
(D)	1 c.c. of B	+	4. c.c.	"	"	"	"	1 c.c.=0.2 mgram.	"
(E)	1 c.c. of B	+	2. c.c.	"	"	"	"	1 c.c.=0.3 mgram.	"

Inoculation is made between the shoulder-blades, and before the inoculation, the temperature must be taken for three successive days every two hours. Injection should be made between 7 and 8 P. M., so as to more carefully note the reaction on the following day. A rise of 0.5° C. is to be regarded as a reaction. If there is only a rise up to 0.4° C., at the end of two or three days, one increases dose to 0.2 milligram. If there is still no reaction, the dose is gradually increased to 10 milligrams (the highest dose). The maximum dose for a child is 5 milligrams. During the reaction the patient should be confined in bed on a light diet. As a rule, reaction following a small dose indicates an incipient tuberculous process, insomuch as a chronic process will only react to large doses.

Tuberculin Inoculation.—Von Pirquet[306] employs tuberculin by inoculation, just as one uses vaccine virus, and the papule resulting in the tuberculous subject resembles that of vaccination. There is no cutaneous reaction in the healthy subject. About 2 drops of diluted tuberculin (old) is placed on the skin and a small scarification is made with a sterile lancet through the drop. The reaction is especially recommended in patients in the first year of life, irrespective of the situation of the tuberculous lesion. Vallée[306] has found the reaction positive in tuberculous animals twenty-four hours after the inoculation. The phenomena at the point of inoculation are: edematous infiltration and a painful grayish-red nodule.

Roux, at a recent meeting of the "Academie des Sciences" (May 27 and June 3, 1907), reported that Vallée was able to confirm in animals the results obtained in the human subject. The cutaneous reaction begins in from twenty-four to forty-eight hours after inoculation, and persists for about six or seven days in tuberculous animals. The reaction, even in mild tuberculosis, consists of a dermatitis, which may proceed to pustulation, whereas there is no reaction in non-tuberculous animals. Ferrand and Lemaire[330] note that the cutaneous reaction in infants was negative in two out of eighteen cases of established tuberculosis, whereas in fifty-five cases which were clinically non-tuberculous, a positive reaction was obtained in twenty-two cases. With the latter subjects tuberculin employed in the conventional way (subcutaneously) was positive in nine, negative in eleven, and doubtful in one case. Butler[380] suggests the following technique for the cutaneous tuberculin vaccination in the diagnosis of tuberculosis:

Make a 25 per cent. solution of old tuberculin in salt solution. A similar dilution is used in which one volume of a 5 per cent. solution of carbolic acid in glycerin is substituted for one of the volumes of salt solution. Place two drops, one of each solution, separated from each other by a space of two inches, on the outside of the arm, which should be prepared as is customary for vaccination. A small lancet, with a dull tip, which is about one-sixteenth of an inch wide and placed vertically in a metal handle, is used to abrade the skin through the vaccine drops by a rotary motion, removing only the upper layers of epidermis. The tip is then cleaned, and at a point midway between the vaccination marks a third abrasion is made, without any tuberculin being applied, to serve as a control. If the reaction is positive, a papule, varying in size from 5 to 20 mm. in diameter, at first bright red, later becoming a dark red with a slight areola, will appear at either vaccination point in the first twenty-four hours; occasionally the papule is delayed to the second twenty-four hours. Sometimes little vesicles with turbid contents, later becoming confluent, appear over the inoculation site. These fade and disappear in the course of several days, leaving at times a little pigmentation. In positive cases in which revaccination is practised, similar reactions result. In localized tuberculous processes, as of the glands and bone, the reaction is especially marked in contrast to the milder reaction seen in persons who have healed foci. At the control point and at all three points, in case the reaction is negative, the slight reddening that follows the scarification disappears in twenty-four hours without any further changes.

Von Pirquet observes that in tuberculous children suffering from *measles* there is no reaction to the cutaneous tuberculin test after the eruption appears, and he suggests that a positive reaction may be utilized in excluding measles.

Ophthalmo-reaction (Calmette[190]).—If this test is positive in a tuberculous subject, there occur in from three to five hours after instillation edema and redness of the conjunctiva; the caruncle becomes swollen and covered by a thin, fibrinous exudate. Temperature is unchanged. The maximum reaction is attained in from six to ten hours and disappears within forty-eight hours. The sound eye is used for comparing the reaction. There is no relation between the intensity of the reaction and gravity of the lesion. In health only the conjunctiva reddens slightly (lasting six hours), but there is no injection of the caruncle nor fibrinous exudate. In adults a 1 per cent. and in children a 0.5 per cent. solution of dry tuberculin is used, and one drop is instilled into the inner angle of one eye. The lids should be held apart for a few minutes after the instillation. Disks containing 0.003 gram of tuberculin may be bought, which when dissolved in 5 minims of distilled water make a 1 per cent. solution. It is always important to secure a reliable tuberculin preparation.

The subconjunctival instillation is of value in cases of *pregnancy* in tuberculous women. A positive reaction shows that such patients have sufficient power for producing antibodies, so that pregnancy may be allowed to continue, whereas a negative reaction proves the deep injury the disease has produced on the self-defending power of the pregnant patient and interruption of the pregnancy is indicated at once (E. Martin).

Indirect Diagnosis of Tuberculosis.—Instead of injecting tuberculin into a supposed tuberculous patient, Mèrieux[227] reverses the procedure, and injects serum from the patient into a tuberculous guinea-pig. The serum acts in the same way as the ordinary reaction to tuberculin, sending the animal's temperature up or down if it is from a tuberculous individual. On the other hand, if the individual is not tuberculous, there is no temperature reaction in the guinea-pig after injection of the serum. He calls the serum from the blood or a blister the "reactional tuberculous product," to distinguish it from tuberculin which is elaborated in cultures of the bacilli. These "reactional tuberculous products" injected into a guinea-pig from three to six weeks after it has been infected with tuberculosis cause a thermic reaction between the second and sixth hours, and again, usually, between the twenty-fourth and thirtieth hours. The temperature varies by one or two centigrade degrees from the preceding temperature of the animal. It generally rises, but may drop. The second change in the temperature may last for several hours and the animal seems depressed.

One may here mention parenthetically a method adopted by Blume[228] when the *sputum* of the patient in suspected tuberculosis is either absent or scanty: The patient is directed to cough on eight to ten successive mornings against an ordinary microscope slide held in a wire frame. At the end of this period the slide is examined in the usual way. The writer has thus been able to demonstrate tubercle bacilli when the clinical symptoms were in themselves insufficient for the establishment of a positive diagnosis. Only typical forms may be considered diagnostic. In the *treatment* of tuberculosis Koch's new tuberculin (T. R.) is used. It is milder than the old preparation and has many advocates, but its use is necessarily limited, for the reason that it must be avoided in all cases of mixed infections.

Moro employs an ointment for obtaining a skin-reaction with tuberculin. The ointment consists of anhydrous lanolin containing 50 per cent. of old tuberculin. When kept in the ice-box, the preparation retains its efficiency for months. The application is made to the skin of the abdomen or the neighborhood of the nipple. A portion of the ointment, the size of a pea, is rubbed in with the finger for about one minute, and no dressing is applied after the skin is left uncovered for about ten minutes. In negative cases the skin shows no reaction, but a positive reaction is manifested by an eruption of papules at the site of inunction. If the reaction is positive, although weak, the papules appear in from twenty-four to forty-eight hours, whereas in a strong reaction the papules appear within a few hours. Compared to tuberculin inoculation (*vide supra*), the percentage of positive results is smaller and, as opposed to the conjunctival and subcutaneous applications of tuberculin, the method of Moro is entirely harmless.

Nagelschmidt, referring to the diagnosis of tuberculous affections of the skin, observes that if a drop of tuberculin is inoculated into a *tuberculous lesion of the skin*, ulceration ensues. In the sound skin such inoculation causes a papule to develop, but no ulceration. He has found this an excellent means of determining whether a lupous patch has entirely healed under Finsen treatment, or whether there are still some points left, especially those embedded in cicatricial tissue, which it is difficult for the Finsen rays to reach. The inoculation has not only diagnostic value, but also a direct curative action, as the nodules heal definitely under the influence of the transient ulceration. Minimal quantities of tuberculin suffice for the reaction. He deposits two or three drops of tuberculin around the lesion and scrapes the skin between them. After fifteen or twenty seconds he wipes off the tuberculin without touching the excoriated part. This avoids absorption of superfluous tuberculin and prevents any general reaction. Sometimes he injects a small drop of tuberculin directly into the nodule. He commends his local tuberculin treatment for lupus when Finsen treatment is not accessible, especially for isolated foci; also for differentiation of tuberculous cutaneous affections, and as supplementary to other methods of treatment. Its drawbacks are the loss of substance left by the ulceration and the liability to a general reaction if too much tuberculin is absorbed. Senger employs a 3 per cent. tuberculin-lanolin salve in differentiating a tuberculous or lupus lesion from an ulceration of other origin. There is no general but a local reaction (inflammation and suppuration which stop abruptly at the edge of the lesion), which he compares to an explosion. The inflammation and suppuration following the application have a curative action.

Typhoid Fever Serum Test.—Typhoid fever is not only an imitator of diseases, as Herrick observes, but many diseases imitate typhoid fever. The serum test for this disease (agglutination test) can be executed by the microscopic or macroscopic methods. The microscopic is the more rapid of the two methods, and consists of adding typhoid blood or serum to a twenty-four-hour bouillon culture of the typhoid bacillus. If the typhoid reaction is positive, the bacilli lose their motility and collect in clumps. The degree of dilution and the time limit are important. If the reaction occurs within one hour with a dilution of 1 part of blood or serum to 19 parts of a bouillon culture, the diagnosis of typhoid fever is practically positive. Dried blood or, better still, the serum from a blister may be used for examination. The macroscopic or ***Ficker diagnostic*** is a reliable method, and can be used by the physician who cannot procure active bacilli cultures. In the macroscopic method, cultures of dead bacilli are now sold with apparatus and directions, either as the "Typhoid Diagnostic" or "Typhoid Agglutometer." After puncture of the finger 1 c.c. of blood is collected in a small blood-tube. After separation of the serum, it is diluted according to definite percentages, and if the test is positive, the dead bacilli agglutinate and sink to the bottom of the tube within twelve hours with a clear supernatant fluid.

Conclusions.—(1) A positive reaction indicates that typhoid fever exists or that the patient has had the disease within one year. A reaction may occur thirty years after an attack of typhoid fever. (2) A positive reaction, according to Cabot, was obtained in 97.2 per cent. of his cases. A reaction may not be obtained in typical cases, and in other instances it may be delayed until convalescence or occur during a relapse. (3) A reaction may be absent with low and present with high dilutions. (4) The agglutinating substances do not appear in the blood in sufficient amount to yield a reaction until the fourth day of the disease; from the fourth to the seventh day, 70 per cent. of the cases give a reaction; eighth to fourteenth day, 80 per cent.; and during the third and fourth weeks, a reaction is elicited in 90 per cent. of the cases. A reaction has been noted in Weil's disease, infectious cholangitis, and in cases of pyrexia with icterus. Meroni has recently tested the *ocular reaction* with typhoid toxin, and found that the reaction may be positive in other affections than typhoid fever. An individual with a sensitive conjunctiva may react to instillations of even an indifferent substance, like sterile bouillon, yet if, after twenty-four hours, a suspected typhoid patient shows no reaction with typhoid toxin, the disease may be excluded.

Vaccination.—Reference has already been made to the influence of vaccination with glycerinated calf lymph upon other diseases (page 178). Stern[67] has noted the disappearance of pains of a gouty or rheumatic character following the inoculation of vaccine virus. He regards this reaction as of some diagnostic value, but is not prepared to admit its limitations. The cases cited in his contribution are quite suggestive in demonstrating the value of vaccination in lithemic pains which prove resistant to the conventional methods of treatment. Vaccination seems to have not only a beneficial but a curative action in many cases of pertussis. If a child has been previously successfully vaccinated, a revaccination is of no therapeutic value. Improvement is noted within a day or so of the development of the pustule, and cure in one or two weeks.

CARMINATIVES.

These are drugs which assist in the expulsion of gas from the stomach or intestines, but chiefly from the former viscus. They probably act by relaxing the orifices and aid in preventing the formation of flatus by increasing the muscular tonus of the alimentary canal. *Gases in the stomach* may be attributed to the following causes: (1) From fermentation or decomposition of food, separation of the gases from the blood through exchange or otherwise, and possibly from secretion of the glands. (2) Regurgitation from the intestines in abnormal relaxation of the pylorus. (3) Swallowing of air and the action of acid upon carbonates contained in the swallowed saliva or food. Effervescent drinks also produce gases. In hysteric and neurasthenic persons nervous belching is a frequent and annoying phenomenon. The majority of writers accept Weissgerber's explanation of the origin, viz., that in hysteria there is increased contractility of the stomach, which paroxysmally forces the gases through the cardia, which is more easily overcome than the tightly contracted pylorus. This theory is based on the assumption that eructation is an active and not a passive process. Bristowe refers the origin of the phenomenon to contraction of the muscles of the neck which raise the gas from the esophagus. The eructated gases are tasteless and odorless, showing that they are not fermentative products, but probably only the atmospheric air which has been swallowed. This view is supported by the fact that the stomach, however distended, could never wholly supply the large volume of gases. I have had an opportunity to examine a number of such patients by means of the Röntgen rays and noted absolutely no contractility of the stomach during the time of the eructations. These observations support the esophageal theory of the gaseous eructations.[58] Reference has been made elsewhere (Figs. 5 and 6) to the influence of a stomach dilated by gas on the neighboring organs and the symptoms arising therefrom. Such symptoms may be provoked artificially by insufflation of the stomach (*vide* etiologic diagnosis). Many functional cardiac neuroses, asthmatic paroxysms, and even attacks of true angina pectoris may be evoked by gaseous distention of the stomach. Careful inquiry in such instances often elicits the fact that when eructations of gas occur the attacks subside. Such paroxysms occur at night, and to determine whether they have any connection with gastric distention, I direct the patient to have at his side some powerful carminative. An efficient means of removing accumulations of gas in the stomach is to dissolve about 30 grains of sodium bicarbonate in hot water, to which can be added about 15 drops of spirit of peppermint. Very often the attack is at once relieved with the expulsion of gas. If the gaseous distention is located in the bowels, the relief is not so rapid; and if it does occur, it is coincident with the discharge of flatus from the rectum. It is a noteworthy fact that many patients do not suffer from dyspeptic symptoms. Determination of the gastro-intestinal genesis of the symptoms serves likewise as a clue to the method of treatment to be pursued. As a carminative, I usually employ *spiritus ætheris compositus* in doses of 1 to 2 fldr., diluted with water. The dose may be repeated. Other efficient carminatives with their doses are: *Oleum menthæ piperitæ* (1 to 5 min.), *Tinctura cardamomi* (1 to 2 fldr.), *Tinctura zingiberis* (20 to 60 min.), *Oleum fœniculi* (1 to 5 min.), and *Oleum anisi* (2 to 5 min.). If a patient takes a certain quantity of water in the mouth and only swallows with the head thrown backward as far as possible, gases from the stomach may be eructated.

CATHARTICS.

These drugs act by augmenting the peristaltic movements and the quantity of intestinal secretion. Drugs which have a specific action on the biliary secretion are known as *cholagogues*. Examples of the latter are: aloes, colchicum, colocynth, ipecac, jalap, podophyllin, sodium phosphate, and sodium sulphate. According to the intensity of action, all things being equal, cathartics are divided into: (1) **laxatives,** which are the least irritating and produce stools nearly normal in appearance: cascara sagrada, cassia fistula, magnesia, manna, ox-gall, sulphur, and tamarind; (2) **purgatives,** which produce one or more copious movements, semiliquid in consistency: aloes, calomel, castor oil, rhubarb, and senna; (3) **drastics,** which are very powerful in action and may create inflammatory disturbances in the gastro-intestinal canal: colocynth, croton oil, gamboge, jalap, podophyllum, and scammony; (4) **hydragogues,** which produce watery stools unaccompanied by irritation: magnesium citrate, magnesium sulphate, potassium and sodium tartrate, sodium phosphate, and sodium sulphate.

In my early practice I was in doubt about the treatment of a certain patient, and I sought the advice of an elderly physician. His counsel was sententious: "Open the bowels." Some people's conception of heaven is a purgative. "Put your trust in God and keep your bowels open," said a good Methodist parson to a sick sister. So potent an influence does a free evacuation have on the condition of well-being, that Voltaire was induced to write: "Those persons who are in good position, whose bowels are freed by an easy, regular, peristaltic movement every morning as soon as they have breakfasted—those who are thus favored by nature are mild, affable, gracious, kind. A 'no' from their mouth comes with more grace than a 'yes' from the mouth of one that is constipated." The melancholy moods of Byron were so pronounced that once when he was writing "Childe Harold" he was tempted to blow his brains out; but he did not because it would have pleased his mother-in-law. "Talk of champagne," said Byron, "nothing cheers the spirits like a dose of salts." "Good purging is a good cure" (Jacobi) and justifies the aphorism, *qui bene purgat, bene curat.* The physician, however, who knows when and not to give a purgative has mastered one of the most important principles in therapeutics.

What constitutes constipation? We do not, as a rule, seek to analyze this question, and content ourselves with the bare statement of the patient. I place no reliance on the latter. An examination of the abdomen by light percussion will often reveal by dullness the presence of stagnated feces at different curvatures, viz., the head of the colon, the hepatic, splenic, and sigmoid flexures. Even though diarrhea is present, one may find fecal masses lodged in the rectum or along the colon. In such instances the fecal masses become channeled. There is much in the paradoxic observation: the chief duty of the consultant is to examine the rectum. There were six of us in consultation. All admitted that there was an abdominal tumor: it could be felt, it was movable, and it was painless. Six different diagnoses were made and all were wrong. Celiotomy was done, and a fecal mass was revealed in the caput coli. In another instance a diagnosis of cancer of the colon was made, and at the operation the tumor was found to be a fecal mass which had undergone calcification (enterolith), but after the removal of the enterolith we found a carcinomatous infiltration of the colon. As a corollary to the preceding, the chief diagnostic aids in the examination of the abdomen are cathartics and enemata.

Test for Constipation.—Grant[59] suggests giving a tablespoonful of animal charcoal. Normally it appears in the stools in twenty-four hours. By this means, even though the patient affirms that he is or is not constipated, the charcoal test will decide the question. (*Vide* test diet in chapter Diagnosis of Visceral Sufficiency.) Dr. C. M. Cooper, of San Francisco, in a personal communication, resorts to the following test to determine the origin of constipation. The test is based on the fact that, in the norm, the passage of charcoal or bismuth (which blacken the feces) from the stomach to the rectum is attained in from twelve to forty-eight hours. If more than seventy-two hours elapse before colored feces are detected in the rectum, constipation is present. Hertz, of London, has shown that, if after the lapse of forty-eight hours the rectum is empty or, as Cooper shows, if the sigmoidoscope demonstrates the presence of blackened feces lodged in the sigmoid, there is some retardation from the middle of the transverse colon. If feces lodge in the rectum longer than twenty-four hours, then the constipation is rectal in origin, dependent on one of the following causes: Loss of the reflex of defecation, from anesthesia or neglect (indolence, false pride, pain of fissures or hemorrhoids), atony or paresis of the rectum and weakness of the voluntary muscles of defecation. I have repeatedly shown in the literature[62] that many reflexes may be elicited by concussion of the spines of the vertebræ. For this purpose I use a heavy percussion hammer (Fig. 27) and a thick strip of linoleum (2 inches wide and about 6 inches long). Now if the spines of the first three lumbar vertebræ are struck a series of vigorous blows, the linoleum being interposed as a pleximeter, it will be noted that the abdomen, which formerly yielded a tympanitic, will now elicit on percussion a dull sound. This is the normal *intestinal reflex*. In constipated individuals the reflex is absent, *i. e.*, the percussion sound remains, as before, a tympanitic

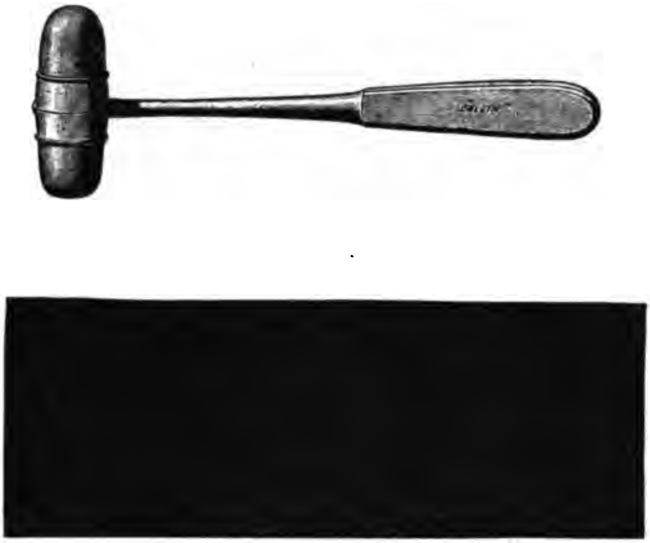

Fig. 27.—Hammer and pleximeter for concussion. The former carries at its extremity a solid piece of rubber (7 cm. in length and 3 cm. wide), whereas the pleximeter consists of a strip of linoleum (½ cm. thick, 16 cm. long, and 3½ cm. wide).

one. Not only are we thus able objectively to determine the existence of constipation, but can also say what part of the bowel is implicated. Very often the dullness is obtained only over the ascending or descending colon, showing that wherever dullness is obtained, that portion of the intestinal canal is not involved in constipation. Vibratory massage of the three first lumbar vertebræ is often efficient, but not constantly so, in curing constipation. Two forms of constipation are differentiated: *atonic and spastic constipation.* The former is dependent on an inherent enfeeblement of the intestinal musculature; the latter is less frequent, and is caused by a tonic contraction of intestinal segments which hold back fecal masses. There is always a feeling in the spastic form as if the evacuation were unsatisfactory. The patients press a great deal at stool and evacuate long, thin, and flattened fecal masses. On palpation of the abdomen one may detect localized contractions, especially of the transverse colon (*corde colique*). The implicated intestinal segment may be rolled under the finger like a cord. Percussion over the spastic intestinal areas yields a dull in lieu of a tympanitic sound. Normally, when one scratches the abdominal skin over a dull intestinal area or by a few blows directed against the epigastrium, the dullness becomes tympanitic, owing to temporary dilatation of the intestine (intestinal reflex of dilation). The percussion sound of the spastic intestine does not change. My intestinal reflex test proves of some service in the recognition of spastic constipation. As a rule, the spastic form does not lead to meteorism, yet in rare instances there may be symptoms corresponding to ileus, and even celiotomy has been performed by mistake. In the spastic form not only are cathartics useless, but they accentuate the symptoms. *Atropin* constitutes both a diagnostic and a therapeutic agent in spastic constipation. Atropin sulphate (dose, $\frac{1}{150}$ to $\frac{1}{60}$ grain) should be tried alone in moderately large doses several times a day. When symptoms suggesting ileus arise, large doses hypodermatically should be given. Large doses are tolerated, and may be repeated until toxic symptoms are manifested. Morphin (hypodermatically) is the physiologic antidote, and may be used to control toxic symptoms. A meat diet increases, whereas purées of vegetables, especially potatoes, diminish the enteric spasticity. By the term *fragmentary constipation*, Boas refers to regular bowel-movements, but the emptying of the bowel is incomplete, leading to frequently recurring desire to go to stool. This condition, most often observed in men, is dependent on an atony of the lower bowel, especially the rectum, which is often filled with feces. Enemata of cold water yield good results. *Tympanites* may be peritoneal from perforation or merely intestinal. By concussion of the vertebræ, as above noted, with the object of eliciting the intestinal reflex, the latter would be absent in peritoneal, and present in intestinal, tympanites; at any rate, the intestinal percussion sound would be modified. No symptom, however humble, has failed to be attributed to constipation, all the way from poisoning (*copremia*) from the resorption of toxic products from the retained feces to grave nervous disturbances. Judicious gastro-intestinal sluicing will aid in deciding this question. We must also remember, when the etiology of *chlorosis* is to be determined, the famous dictum of Sir Andrew Clark, viz., that if he were limited to the choice of one drug in the treatment of the disease, he would choose a purgative. This, carried to its logical sequence, signifies that a chalybeate is to be used in conjunction with a mild purgative.

An old-time method of treating *sciatica* was by means of an enema and a purgative. We know that neuralgia of the sacral nerves may be provoked by an overloaded sigmoid flexure, and, I may also add, an overloaded caput coli, hence the use of purgatives and enemata should not be limited to sinistral sciatica. The time of Louis XIV. may be conceived medically as the enemata-mania epoch, for Louis and his courtiers had their bowels opened many times a day by aid of enemata, and they no doubt did good as a safeguard against overeating and overdrinking.

Recalling some of the physiologic effects of cathartics, we can make them available for purposes of diagnosis. They eliminate noxious material from the bowels which may be the cause of many symptoms. Thus, *fever* may be present from habitual constipation alone. Associated with the fever are digestive disturbances and mental depression. In the condition known as "*biliousness*," when the tongue is coated, the complexion sallow, and the stools pale, scanty, and offensive, the use of cholagogs, notably small and divided doses of calomel, will effect immediate and almost marvelous results. These so-called cases of biliousness may pursue a chronic course and give rise to many nervous symptoms, notably neurasthenic in character. One may recognize such patients by their "bilious complexion" and pigmentations over the body, especially the backs of the hands and feet. Constipation may alternate with diarrhea, and a deep despondency is a conspicuous symptom. These are cases of *cholemia*, and are caused by increased formation of bilirubin, failure of its elimination, or by any hepatic condition which favors its absorption rather than its elimination with the bile into the intestine. The etiology of cholemia is obscure. To detect bilirubin in the blood in cholemia, 2 or 3 c.c. of blood is collected from the punctured finger in a clean, dry cylinder. The latter is placed in a cool place for twenty-four hours without shaking and allowed to clot. The serum is then drawn off and Gmelin's test with crude yellow nitric acid is applied. The acid clots the albumin, but a slight blue ring shows itself just above the point of contact. The reaction may be positive, even with normal serum, but not if the latter is diluted with two-thirds normal salt solution. Hence, with the latter dilution, if the reaction is obtained, cholemia may be said to exist. In these cases cholagogs are efficient, and Richardson,[90] who has had considerable experience in such cases, recommends mercury in small doses in combination with sodium glycocholate. All hepatic stimulants, notably sodium salicylate, are beneficial.

The *hydragog cathartics* promote absorption. Supposing we are in doubt whether a dullness in a given thoracic region or abdomen is dependent on fluid. Determine the level of the dullness and administer some efficient hydragog cathartic for several days. Note again the level of the dullness by percussion, and if it is reduced, the dullness in question is probably due to fluid. *Diuretics* may be employed with the same object in view. In place of a dermographic pencil for marking the height of the dullness, which may become effaced, tincture of iodin may be used, applied by means of a match. The mark of the latter is more permanent. A stick of nitrate of silver has also been used for the same purpose. The stain of iodin may be removed by ammonia due to the formation of soluble NH_4I. The silver stain can be removed by applying a drop of iodin tincture, and then ammonia, owing to the formation of AgI, which is soluble in ammonia.

Cathartics help to eliminate toxic products from the blood, hence they may prove of value in determining the cause of convulsions and other symptoms of a nervous nature. Cathartics deplete the brain by sending a large quantity of blood to the intra-abdominal blood-vessels, hence headaches caused by cerebral hyperemia may be relieved, and further extravasation of blood is prevented in cerebral hemorrhage. In many instances one may quickly determine whether certain phenomena, such as headache and neuralgia, are dependent on cerebral congestion. My method[61] is to apply a large vacuum cup over the abdomen and practise *suction* by the aid of a pump. Large quantities of blood, as I have shown, can be forced to the abdominal vessels. Suction after this manner will relieve many symptoms dependent on an overloaded right ventricle, and can thus be utilized in diagnosis and treatment. In the latter instance I have had my nurses maintain suction for hours at a time, and have thus given much relief to patients in pneumonia. The method is equivalent to *cardiocentesis* without the dangers of heart puncture.

If constipation is dependent on some painful condition of the anus (fissure, eczema, etc.), the previous use of a cocain suppository, by relieving the pain, will direct attention to the cause of the constipation. Hyperesthesia of the pelvic viscera causes constipation, on account of the inability to properly employ the abdominal muscles at stool, or on account of the fecal masses coming in contact with the tender structures. Here the use of a few large doses of any of the bromids, or a dose of phenacetin, antipyrin, or other analgesic, may enable one to say what influence is exerted by such hyperesthesia in constipation. In the early recognition of *pneumonia* in infants and young children Northrup observes that the administration of a purgative will cause a temporary decline of the fever, but which soon reaches its former level. This feature he considers a useful aid in early diagnosis. The symptoms of many neuropathic conditions, notably *enteroptosis*, are often aggravated by bowel movements and relieved by constipation. The latter may be encouraged in such instances. *Backache* dependent on intestinal distention is relieved after a bowel movement.

In *typhoid fever* a very mild laxative has often afforded me valuable diagnostic signs. Notwithstanding constipation, diarrhea frequently follows the administration of a single dose of a mild laxative; if it does not, the belly becomes more tympanitic, and gurgling upon palpation is accentuated in the ileocecal region.

CEREBRAL EXCITANTS.

When considering the *anticonvulsants*, reference was made to drugs which could produce epileptiform convulsions. Such drugs belong to the cerebral excitants. Some of the cardiac sedatives in toxic doses (aconite, antimony, and veratrum) have a similar action, but probably do not act directly on the motor centers, but by a disturbance of the circulation at the base of the brain. Some of the cerebral excitants, like alcohol, coca, cannabis indica, and opium, exalt imagination and emotion before their depressive effects are expressed. Then there are drugs which cause delirium, viz., alcohol, belladonna, cannabis indica, chloroform, coca, ether, hyoscyamus, etc.

Belladonna.—Therapeutic doses quicken the pulse by depressing the inhibitory and stimulating the accelerator nerves. Increased blood-pressure results from stimulation of the heart and vasomotor center. Large doses paralyze the non-striated muscles. All secretions except those of the kidneys and intestines are decreased. The pupils are dilated by stimulation of the sympathetic and by paralysis of the peripheral branches of the oculomotor nerve. The power of accommodation is destroyed and intraocular tension is augmented. Hyoscyamus and stramonium act like belladonna. The most reliable liquid preparation is *Tinctura belladonnæ foliorum*. Dose, 5 to 20 minims. For diagnostic purposes, its alkaloid, *atropin*, especially the salt, *atropin sulphate* (dose, $\frac{1}{150}$ to $\frac{1}{60}$ grain), should usually be employed.

The action of belladonna on the sensory nerve-endings is slight, and any local anodyne or anesthetic effect must be attributed to depression of the motor nerve filaments by which spasm is relaxed. Hence, in localized *spasms* of the bladder, anal sphincter, intestines, and in dysmenorrhea, belladonna administered alone, either internally or externally in suppository form, will enable us to estimate how far spasm is related to the symptoms. Constipation, for instance, may be caused by spasm of the anal sphincter. Here the use of a belladonna suppository previous to defecation, by relaxing the spasm, will permit of an easy evacuation.

Belladonna is often efficient in *incontinence of urine*, and at other times practically valueless. It is efficient in those instances when incontinence is dependent on spasm of the bladder. Still attributes the failures in the use of belladonna in enuresis to the use of doses which are too small. Children usually tolerate belladonna well, and at any period beyond infancy 5 minims of the tincture should only be considered as an initial dose. If the parents are intelligent and are forewarned of the possible toxic symptoms, it is usually safe to begin with 10 minims for a child over five years of age. The dose should be increased by 2½ minims every fifth or sixth day until either the enuresis is stopped or the limit of tolerance is reached. If the enuresis is controlled, say, by 17 minims three times a day, it is well to "make assurance doubly sure" by pushing the dose slightly further by an additional 2 minims if tolerance allows. The dose should be maintained at this level, just beyond the minimum efficient dose, for a fortnight, and then reduced by decreases of 2 minims once a week, and so gradually discontinued. Similarly, spasmodic *torticollis* often yields to intramuscular injections of atropin. In the use of belladonna or atropin, it must be pushed to the point of causing dryness of the throat and dilatation of the pupils.

It is stated that when *diarrhea* is dependent upon central influence it is often checked by atropin, but is uninfluenced if the cause is resident in the intestine itself.

Matutinal vomiting occurs quite independent of any gastric affection, and may occur in ptyalism when saliva is unconsciously swallowed at night, and even when no ptyalism is present. A dose of atropin at night, by inhibiting the flow of saliva, will often direct attention to the true source of vomiting. It is evident that a sialagog like *pilocarpin*, given at night, would increase vomiting from the same cause. I have likewise found atropin of value in checking an excessive secretion of semen (*polyspermia*), and nocturnal emission due to this cause may be controlled.

Cough dependent on an excess of secretion is beneficially influenced by atropin, which diminishes the bronchial secretion.

The anhydrotic action of atropin may be useful in determining whether the exhaustion experienced by the *consumptive* is wholly due to night-sweats. Here small doses of atropin ($\frac{1}{200}$ grain) at night may be useful.

Belladonna has a varied use in the diagnosis of *ocular affections*. For dilating the pupil (*vide* Cocain, page 214) a solution (one-half to 2 per cent.) of atropin sulphate is used. Two or three drops instilled at intervals of ten minutes will produce maximum dilatation in half an hour after the last dose, and the effects last from one week to ten days. Increased *intraocular tension* should prohibit its use. Atropin is usually substituted by **homatropin hydrobromate**, for the reason that the action of the latter only lasts twenty-four or thirty-six hours. A 2 per cent. solution is used, and 1 drop is instilled every five minutes until the pupil is sufficiently dilated. For ophthalmoscopic examination, **euphthalmin** is the most practical drug for the physician, but as it has only a feeble effect on accommodation, atropin is used when it is necessary to paralyze the ciliary muscle for determining the refraction power of the media and to determine if headache is caused by spasmodic contraction of the ciliary muscle. Many disturbances dependent on errors of refraction may be determined by the relief of the symptoms after paralyzing accommodation by means of atropin. Peripheral cataracts may be seen after complete dilatation of the pupils, and atropin is useful in a central opacity when it is desirable to have the patient see around such an opacity. Atropin is employed to secure full dilatation of the pupil in cataract as a means of ascertaining when the operation should be made. The cataract is said to be mature when there is no longer any vision even with the pupil dilated.

If an excess of atropin has been used in the eye, its effects may be counteracted by the use of *miotics*, which diminish the size of the pupil and also reduce intraocular tension. For the latter purpose **eserin** and **pilocarpin** are employed, and the latter in preference to the former, because it is usually unattended by untoward effects. A 1 per cent. solution of pilocarpin muriate is used.

Ordinarily both eyes are concerned in vision, both eyes being so adjusted that the image of an object is focused on the macula of each eye. The fusion of the two images gives a single mental perception. In *strabismus* the vision of the squinting eye may be defective, and to determine how much of the defect is caused by the squint, atropin is instilled into the fixing eye, so that it cannot be used for near vision. Thus the child is compelled to employ the squinting eye for seeing close objects.

It has been suggested that *seasickness* is associated with some disturbance of accommodation, and Sharpe[63] recommends the instillation of 2 or 3 drops of a solution of atropin sulphate (1:125) into the conjunctival sac of one eye for the purpose of annulling the power of accommodation in this eye. Binding over one eye is said to secure like immunity.

Reference has already been made to the use of atropin in *spasmodic constipation.* Within the last few years marvelous results have been achieved in *intestinal obstruction.* It was supposed that good results could be attained only when the obstruction was dependent on a spasmodic condition of the intestines, but later observations show that atropin is equally effective in paralytic conditions, for it not only relaxes spasm, but also augments the tone of the paralyzed intestines. Atropin should always be tried in such conditions, for if it has any action at all, it is immediate, so that no unnecessary time is consumed if operative interference becomes necessary. It must be used in large doses hypodermatically, and the patients seem to tolerate quantities which under other circumstances would prove toxic.

At first an experimental hypodermatic injection should be made with $\frac{1}{60}$ grain, and if there is no pulsation in the arteries nor redness of the face, then an injection of double this quantity may be used after one hour. Very often within an hour the abdomen becomes softer and gas is expelled from the rectum. After a few hours another injection may be given, and repeated if necessary until the patient has recovered. If the symptoms do not abate, then an operation is indicated.

An *incarcerated hernia* often resists taxis owing to reflex tetanic irritation of the external oblique muscle. To eliminate this factor, a hypodermatic injection of a large dose of atropin into the muscle near the hernia is indicated. In several instances I have succeeded in reducing a hernia by freezing the latter with a spray of rhigolene or ethyl chlorid.

Arrhythmia, or intermittency of the heart, must be determined by cardiac auscultation, and not by palpation of the pulse, insomuch as a feeble heart contraction may not give rise to an arterial pulse. Disturbances of the cardiac rhythm may be organic, from myocarditis or coronary sclerosis, or functional. In the latter instance arrhythmia may occur without adequate cause in youthful and adult subjects. In many instances toxic agents, like tobacco, coffee, tea, etc., are concerned, and in others, flatulent dyspepsia is a prominent reflex factor. Organic arrhythmia is a serious condition, whereas the functional form is of little import. It has been shown that an irregular pulse may arise from vagus stimulation, which not only slows the heart-rate, but may also create irregularities in rhythm. By eliminating this vagus influence by atropin the irregularities will disappear, and thus the drug in question demonstrates the neurogenic character of the irregularity. In other words, if we administer $\frac{1}{120}$ to $\frac{1}{60}$ grain of atropin to paralyze vagus action and the pulse becomes regular, we conclude that the heart-block is functional; otherwise, the heart-block is organic, and that the lesion is situated near the auriculo-ventricular bundle of His. Such an organic heart-block occurring in young adults and middle-aged men is very frequently of syphilitic origin. I have noted in myself and others, arrhythmia when an intercostal neuralgia implicated the upper dorsal nerves. The arrhythmia usually yields at once to freezing. The typic signs of intercostal neuralgia may be absent, and the only sign present may be vertebral tenderness on percussion. The author is persuaded to direct attention to the foregoing fact as an etiologic factor in arrhythmia. He has also shown that, even in the norm, pressure made at the side of the upper dorsal vertebra will inhibit the action of the heart. In some instances firm pressure on a vertebra alone will arrest the radial pulse.

The atropin test has also been employed in the diagnosis of *bradycardia*. As is well known to physiologists, atropin paralyzes the motor endings of the vagus. An injection of 0.001 gm. (gr. $\frac{1}{65}$) induces habitually a transitory tachycardia, which commences in from twenty to thirty minutes after the hypodermatic injection and disappears in from one to three hours. During the period of its action the number of cardiac pulsations may be double the normal. In Stokes-Adams' disease (heart-block) associated with a lesion of the bundle of His, the atropin does not provoke any augmentation of the ventricular contractions, but, on the contrary, accelerates the rhythm of the auricles, as can be demonstrated by comparison of the radial pulse with that of the jugular. One is justified in concluding that if in bradycardia the radial pulse is accelerated after employing the atropin test, one may usually exclude an organic cause of the trouble, and may refer it to a nervous origin. The action of atropin on the heart-rate is less in childhood and old age than it is between the ages of twenty and sixty years, owing to the fact that inhibition of the vagus is feebly expressed at the extremes of life in man.

If *asthma* is caused, according to the prevailing theory, by spasmodic constriction of the bronchioles, then drugs like atropin, hyoscyamin, and chloroform, which dilate the bronchi, must prove efficient. Atropin, however, is one of the most satisfactory drugs in asthma. Aside from its action in inhibiting bronchial spasm, it diminishes secretion, reduces the sensitiveness of the mucous membranes to reflexes, and stimulates the respiratory center.

Inebriety.—In many instances this is said to yield to atropin. McBride's treatment for inebriety is as follows:

First week..........	*Atropin,*	$\frac{1}{100}$	grain;	*Strychnin,*	$\frac{1}{60}$	grain,	t. i. d.
Second week........	"	$\frac{1}{60}$	"	"	$\frac{1}{30}$	"	"
Third week.........	"	$\frac{1}{50}$	"	"	$\frac{1}{30}$	"	"
Fourth week........	"	$\frac{1}{100}$	"	*sine* strychnin;			

together with a mixture of cinchona extract, sal volatile, and spirit of chloroform.

Tincture of capsicum has also been extensively employed for subduing the craving for alcohol.

CIRCULATORY STIMULANTS.

Digitalis.—In therapeutic doses the pulse is diminished in frequency and blood-pressure is raised. The former is due to prolongation of the diastole from stimulation of the vagi, and the latter in part to stimulation of the cardiac muscle and in part to a constriction of the arterioles resulting from stimulation of the vasomotor center and the direct action of digitalis on the walls of the arterioles. In disease, the augmented arterial tension causes diuresis. The action of digitalis may be divided into two periods: (1) Therapeutic stadium, in which the cardiac force is increased;

(2) toxic stadium, when such force is diminished. In the first stadium slowing of the pulse is slight, whereas in the second stadium it is very much diminished in frequency, and may even become arrhythmic. This excessive slowing of the pulse may be accepted as the primary signal of the toxic action of digitalis. We must remember that the drug also constricts the coronary arteries, thus compromising the nutrition of the myocardium. The chief effects of digitalis are exerted on the heart muscle, and the greater the integrity of this muscle, the better the action of the drug on the heart; hence such reaction may be accepted as a diagnostic indication of the condition of the cardiac muscle. Again, many of the preparations of digitalis are practically inert, and this fact may be demonstrated by its physiologic action. Within thirty-six hours after the use of a reliable preparation given in adequate doses, one finds that the pulse becomes stronger, more regular, and slightly decreased in frequency (provided the pulse was accelerated prior to the use of the drug), and there is an increased excretion of urine. By estimating the quantity of urine excreted one is afforded a guide in a dual direction: the reliability of the drug and the efficiency of the cardiac muscle. The average quantity of urine excreted in twenty-four hours in a healthy adult is about 1500 c.c. In cardiac muscular insufficiency the quantity may be diminished by one-half or more. Owing to the delayed action of digitalis, an increase in the quantity of urine does not occur until the second day of its use; then it continues to increase day after day until the normal is attained. At this time, and when the pulse frequency has been reduced and the tension is increased, one should withdraw the drug, reduce the dose, or give it less frequently. In using digitalis for diagnostic or therapeutic purposes, I first unload the bowels and diminish hepatic congestion by means of a few small doses of calomel. I use a reliable preparation of the infusion of digitalis combined with diuretin (sodio-theobromin salicylate). I give the infusion in 4-fldr. doses and the diuretin in 15-grain doses. The diuretin is a powerful diuretic and antagonizes the vasoconstrictor components of digitalis. I rarely allow an indication or contraindication to guide me in its employment. No theory can guide the practitioner in the use of digitalis, and its tentative administration is always warranted, provided the physician begins with small doses and is prepared to

recognize its untoward effects. Ordinary discretion must be employed. Thus, one would not administer digitalis merely because a cardiac murmur has been discovered, nor in the stage of compensation. Digitalis is the sovereign heart tonic, and is correctly specified as the quinin of the heart. As a rule, when the digitalis-diuretin combination fails, little can be expected from the substitutes of the drug. Löwy has shown that a digitalis infusion is weakened by the acid of the gastric juice, and that an infusion allowed to stand at room temperature for twenty-four hours is reduced in active strength to one-half. The latter effect is caused by the presence of an organic acid in the infusion, and can usually be prevented by neutralization. All ready-made infusions of digitalis must be rejected and only a fresh infusion should be employed.

Digalen.—This soluble form of digitoxin has been highly praised by many writers. It causes no gastric irritation, is reliable and rapid in its action, signs of accumulation are rarely seen, and its action upon the circulation is prolonged. It is given by the mouth, but preferably subcutaneously. A standard solution is sold containing 0.3 milligram digalen in each cubic centimeter of fluid, and this amount may be given three or four times daily. The daily dose for subcutaneous use is 3 to 4 c.c. of a standard solution representing 0.9 milligram of the drug.

Strophanthus in the form of the tincture is an excellent substitute for digitalis and may be used when the latter is contraindicated. It is well to remember that strophanthus produces little or no constriction of the coronary vessels.

Diagnosis.—An individual may have a *weak heart* even without objective signs, and, again, the only expression of such weakness may be feeble heart tones and a weak and irregular pulse, and the patient may complain of dyspnea on exertion. Such are the manifestations of *myocardial disease*, the diagnosis of which is usually made at the necropsy. Very often we may suspect myocardial disease, even in the absence of objective cardiac signs, when symptoms not unlike those which accompany the broken compensation of valvular diseases present themselves. In such instances we should apply the test for determining the efficiency of the cardiac muscle (*vide* chapter, diagnosis of visceral sufficiency). The use of digitalis will also assist in solving the difficulty. One may

TABLE OF CARDIAC TONICS.*

	DIGITALIS.	CAFFEIN.	STROPHANTHUS.	STRYCHNIN.	ADRENALIN.	SPARTEIN.
PHYSIOLOGIC ACTION....	Stimulation of heart muscle and inhibitory apparatus; contraction of arterioles. Slows heart and increases force of its contractions.	Increases the power and regulates rhythm of heart. Action on the vasomotor center and directly on the heart.	Action like digitalis, but contraction of arterioles less pronounced. Slows heart by direct action and not by vagus stimulation.	Stimulation of the heart and vasomotor center. Pulse becomes stronger and more rapid.	Increased arterial pressure caused by direct action on the heart and constriction of the peripheral blood-vessels. Action rapid but not permanent	Slows and increases volume of pulse. Raises arterial pressure.
TOXIC SYMPTOMS.......	Nausea, vomiting, slow and irregular pulse; syncope, confusion of vision, insomnia, and delirium. A blue sclerotic considered diagnostic.	Overexcites circulatory and nervous systems, thus causing mental excitement, delirium, and rapid pulse.	In large doses, nausea, vomiting, and diarrhea. Eliminated rapidly and has no cumulative effect.	Restlessness, anxiety, twitching of the muscles, and convulsions.	Toxicologic reports are chiefly derived from experimental animals.	Exaggerates reflex action and causes tonic convulsions. Pulse weak and rapid.
INDICATIONS FOR USE...	Failure of compensation irrespective of the nature of the valvular lesion.	Like digitalis. May act when latter fails and useful when digitalis is not indicated.	Same as digitalis. More prompt in action than the latter but less reliable. Used as a substitute for digitalis.	For stimulation of the heart alone or combined with digitalis. Less reliable than the latter, except in the weak heart of elderly persons.	When prompt action is desirable, as in shock and collapse.	Same as digitalis, but appears to be more efficient in the rapid and irregular pulse of functional origin.
CONTRAINDICATIONS....	In established compensation. Theoretically its use is interdicted in aortic incompetency and arteriosclerosis.	Insomnia.	*Vide* Digitalis.	Feeble in action when given *per orem*. Must be used hypodermatically to get the best effects.		
MOST EFFICIENT PREPARATION AND DOSE..	Infusion in ½ oz. and tincture in 10 min. doses, three or four times a day; continued until symptoms are relieved; then replace by strophanthus.	Caffein citrate (2 to 5 grains) in powders or capsules. Decomposed by water. For prompt action hypodermatically use sodio-benzoate of caffein (5 to 10 grains), which is soluble and stable in water.	Tinctura strophanthi (3 to 10 minims). Strophanthin ($\frac{1}{100}$ to $\frac{1}{30}$ grain).	Strychninæ sulphatis ($\frac{1}{30}$ to $\frac{1}{15}$ grain) hypodermatically.	Adrenalin chlorid solution (1 : 1000), P. D. & Co.; 8 to 15 minims for hypodermatic injection.	Spartein sulphate, ¼ grain, increased gradually to 1 grain.

Convallaria (fluidextract, 5 to 20 minims), similar but inferior in action to digitalis. Is efficient in dropsy of cardiac origin.
Adonidin ($\frac{1}{12}$ to ¼ grain). Similar to, but inferior in action to, digitalis. Used as a substitute for the latter.
Cactus Grandiflorus (tincture, 20 to 30 minims). Action similar to digitalis and is often used in functional cardiac affections.

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* "Diseases of the Heart," Albert Abrams, 1900, p. 77.

conclude that the heart muscle is diseased by the following therapeutic test: After giving a reliable preparation of digitalis for five days, there is no diminution of the symptoms of broken compensation (edema and congestion) and there is no rise of the peripheral arterial tension nor increased strength of the pulse. In such instances the drug can do no good and may even be dangerous. I have noted many chronic *dyspeptics* to improve under digitalis when venous congestion of the intra-abdominal veins was suspected. *Epigastric tenderness* dependent on hepatic congestion is very amenable to digitalis treatment. If the pain in question, according to Schmidt, increases, while the other evidences of congestion subside, the complication of gastric ulcer must be suspected (ulcer in a congested stomach). Congestion of the liver serves as a faithful index of incompensation of the right heart. If, under the influence of digitalis, the liver decreases in size and shows less tenderness, we are in a position to say that the compensation of the right ventricle is improving. Many *asthmatics*, so called, really suffer from paroxysmal cardiac dyspnea, and such patients are markedly improved by digitalis until more energetic measures can be employed to make the benefit lasting. One should test the efficiency of the heart in all asthmatics, and if an insufficient heart is found to exist, one is justified in concluding either that the asthma is essentially cardiac or that a "weak heart" may maintain an asthmatic habitus. In either event a course of resistance movements may do much good. The *tracheal traction test*[64] enables one to say whether the dyspnea is of bronchial or cardiac origin; when the head is thrown forcibly backward or to the right or left and the position maintained, the normal resonance obtained by percussion over the manubrium and lungs contiguous thereto becomes converted into a dull or flat sound. The test is positive in health and in all cardiopulmonary affections, but is absent in all cases of idiopathic asthma; hence in cardiac asthma the tracheal traction test is present, but absent in bronchial asthma, *i. e.*, the percussion sound over the manubrium sterni is unchanged. The change in the test is more often recognized by the sense of resistance on percussion. Contraction of the cervical muscles in the maneuver stimulates the vagi, and the latter induce contraction of the bronchial musculature. In idiopathic asthma this musculature is enfeebled, and, not contracting by vagus stimulation, there is no change in the percussion sound or sense of resistance. This tracheal traction test may also be employed for eliciting the râles of asthma when absent. The râles are best heard in the lower lobes of the lungs posteriorly. After this manner an asthmatic lung in the intervals of the paroxysms may also be recognized.

The loudness of a *murmur* is largely dependent on the activity of the heart. Loud murmurs may become weak, and this change is an ominous sign, indicating heart weakness. For the same reason murmurs may disappear in febrile diseases and in the dying state. Faint may often be converted into loud murmurs after increasing cardiac activity by exercise, and when the latter is not possible, digitalis may be used to effect the same object by raising the blood-pressure. When the heart is rapid or irregular in action, it is difficult to determine the time of a murmur. Systolic murmurs are synchronous with the carotid pulse, but more often it is necessary to regulate the action of the heart with digitalis before concluding concerning the time of a murmur. Cardiomuscular murmurs dependent on the delirious condition of the organ disappear after the use of digitalis.

In *tachycardia* resulting from vagus paralysis the heart does not respond to digitalis, because the latter ordinarily inhibits the rapidity of cardiac action by stimulation of the vagi. Here strophanthus is more effective, because it slows the heart by direct action and not by vagus stimulation. In compensated cardiac lesions, especially in simple cardiac hypertrophy, digitalis only increases the cardiac distress.

Many observers regard digitalis as an elective drug in influenza and *pneumonia.* It acts as an antithermic and rapidly controls the symptoms. Having no such rapid action in other infections, they attribute to the drug a diagnostic value.

Digitalis often relieves neuralgic *pains* caused by venous stasis. It has been said, "The weakness of a weak heart is of the greatest possible consequence." Occipital headaches are often associated with a weak heart, and the latter, as a factor in the etiology of such aches, may be demonstrated by the administration of digitalis. In *insufficiency of the tricuspid valves* the absence of the venous pulse may be caused by excessive passive dilatation of the right ventricle, and may be made to reappear after the use of digitalis. A *pericardial effusion* may be inflammatory (pericarditis) or non-inflammatory (hydropericardium), and occurs in Bright's disease, tuberculosis, etc. A rapid disappearance of the symptoms of engorgement and diffused dullness after digitalis are in favor of hydropericardium, but the increased diuresis may modify an inflammatory dullness, although less rapidly; in the latter instance the resorption of the exudate will cause the friction sounds to reappear. *Dilatation* of the heart may be confounded with a pericardial effusion, but the use of digitalis or resistance gymnastics (*q. v.*), by augmenting blood-tension and the vigor of the heart, will aid in differentiation.

Convallaria.—The most reliable preparation of this old remedy for dropsy is the fluidextract, the dose of which is from 5 to 20 minims. It is especially useful in cardiac irregularity, notably in nervous palpitation, and is often effective when digitalis has failed.

COUNTERIRRITANTS.

These substances are *rubefacients* when they produce a skin hyperemia, *vesicants* or *epispastics* when they form blisters, and *pustulants* when they produce pustules. The chief rubefacients are: Aconite, ammonia, arnica, capsicum, chloroform, iodin, mustard, and oil of turpentine. The usual vesicant is cantharides, and the only pustulant is croton oil.

Cantharides.—Preparations of this drug applied to the skin result in vesication. Some of the plasters on the market intended for blistering purposes are useless. Before applying cantharidal collodion or a plaster, wash with soap and water and then dry the skin thoroughly with alcohol, and if a plaster is used, moisten it with a few drops of acetic acid. Vesication occurs in about eight hours. At the end of that time carefully remove the plaster, to avoid rupturing the bleb. The fluid may be obtained by puncturing the bleb with a needle.

Methyl iodid is said to be a more powerful vesicant than cantharides. It has many advantages over the latter and has no unpleasant action on the urinary organs. About 15 to 30 drops of the liquid are poured on a piece of blotting-paper which has been cut to the desired size. The paper is then applied to the skin, which has been cleaned and fastened by means of collodion or a bandage. Blisters appear in from three to eighteen hours. A blister may be produced in several minutes by saturating a piece of lint with chloroform, and after its application covering it with oiled silk or a watch-glass.

Lard and ammonia, equal parts, will blister in about five minutes.

The blister is an excellent medium when we wish to obtain *serum* for diagnostic purposes. In carrying out the Widal test in typhoid fever, I find that such serum being uncolored facilitates the recognition of the reaction. The serum of blisters produced over suspected *leprous patches* may contain the bacilli of leprosy. Garrod originally demonstrated an increase of uric acid in the blood in *gout*, especially in the early stages, by performing the following test with the serum of an artificially produced blister: Add to 2 drams of serum in a watch-glass, 5 minims of acetic acid. In the solution immerse a thread, and in a few hours to a couple of days the latter shows an incrustation of uric acid. If the blood contains only 0.0025 per cent. of uric acid, the characteristic crystals (Fig. 28) may be demonstrated microscopically. In doubtful cases or when a microscope is not at command, the *murexid test* may be used with the incrustations on the thread: Immerse thread in a porcelain dish containing dilute nitric acid and heat to evaporation. There is a reddish residue, which changes to purple red upon the addition of diluted ammonia. This thread test also occurs in chlorosis and leukemia.

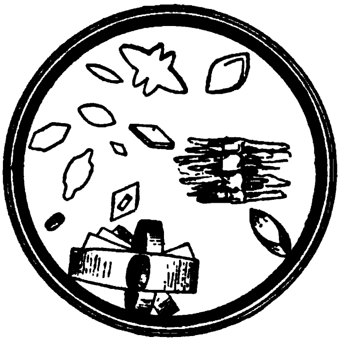


Fig. 28.—Crystals of uric acid.

Many observers have discredited the employment of tuberculin in the diagnosis of *tuberculosis*, believing that it conduces to the dissemination of the infectious material from the tuberculous focus. Flick has shown that the application of a blister to a tuberculous person will cause a decided febrile reaction some hours after the application, due in all probability to the absorption of tuberculin from the blister. Tuberculin has been found in the urine and serous exudates of tuberculous animals, and it has been demonstrated that the fluid obtained from a blister on a tuberculous person will, when injected into a tuberculous animal, produce a definite action.

A blister applied over the precordium will in some instances cause the resorption of a *pericardial effusion.* It is often difficult to differentiate the latter from cardiac dilatation, hence any change in the figure of dullness after the application of a blister speaks for an effusion. A simple method employed by me for differentiation is based on the following fact: If with the hammer and pleximeter (Fig. 27) one concusses the spine of the seventh cervical vertebra, the heart reflex of contraction is evoked, whereas the counterreflex of heart dilatation may be provoked by concussion of the spines of the eighth to the twelfth dorsal vertebræ. In the former instance the area of cardiac dullness will diminish; in the latter, it will be increased in simple heart dilatation, whereas in effusion the area will be uninfluenced. It is important to remember that counterirritation at the site of cutaneous tenderness (*zones of Head*) in visceral disease is frequently followed by immediate relief of pain.

DIAPHORETICS.

Jaborandi.—The principal alkaloid of this preparation, *pilocarpin*, is usually prescribed, owing to the variable strength of the *fluidextract of jaborandi.* Pilocarpin is given in doses of $\frac{1}{16}$ to $\frac{1}{12}$ grain by the mouth, although its hypodermatic use is advocated for diagnostic purposes. It increases all the secretions, notably the sweat and saliva. Its action on the milk and bile is questionable. The sweating and salivation from a full dose may continue for five hours and become manifest within ten minutes (hypodermatically, three to five minutes) after administration. There is an average reduction of temperature of nearly 1 degree under the influence of the drug. Contractions are excited in all the unstriped muscles. Nausea and vomiting are more frequent when the drug is given by the mouth than hypodermatically. It contracts the pupil and diminishes intraocular tension. More recent observations show that the renal secretion is not increased, and Riegel has demonstrated that the gastric flow is augmented. The acidity of the latter, however, is diminished, like that of the urine. In fact, even in a healthy individual the urine may become alkaline after an injection of pilocarpin, owing to the removal of acid in the sweat. Thus pilocarpin has been employed in *gout* and *diabetic coma* to augment the alkalinity of the tissues. Pilocarpin is a valuable remedy in various forms of *pruritus*, given preferably at night, in ⅙-grain doses.

In many forms of *nephritis* we are unable to decide whether the irritability, digestive and ocular disturbances, neuralgias, and headaches are mild symptoms of uremia or quite independent of the latter. The almost immediate relief of the symptoms following the use of the drug internally or hypodermatically decides in favor of uremia. Many years ago I saw in consultation a physician who was in a state of partial coma. He knew he was suffering from interstitial nephritis and expressed the wish that he be kept alive for a few days until he could settle his affairs. He immediately recovered after the use of pilocarpin hypodermatically and lived many months. There is practically no danger in the use of the drug if one begins with small doses and repeats them until the physiologic action is obtained. Normal *sweat* contains 0.084 per cent. of nitrogen (chiefly urea). Three liters of sweat (a not unusual quantity after pilocarpin) removes about 2.5 gm. of nitrogen, and in nephritis this quantity of sweat could remove 8 gm. of nitrogen (Sollmann). Bendix demonstrated that the freezing-point of the blood in uremia could be reduced to normal by diaphoresis. It has been suggested that diaphoresis, while removing part of the toxins in the blood, leaves in a more concentrated form those that remain, and those who are of this belief employ water to substitute the amount lost by diaphoresis.

The sign of Straus in *facial paralysis* is to give the patient a hypodermatic injection of pilocarpin. In paralysis from a central cause the drug causes no appreciable difference in the perspiration of the two sides of the face, either as to time or quantity, whereas there is a marked retardation of the secretion on the affected side in severe peripheral paralysis.

If the *growth of the hair* is retarded and dependent on insufficient circulation in the skin, pilocarpin, by augmenting the latter, is said not only to increase the growth of the hair, but changes it to a darker color.

A dry *cough* caused by deficient secretion may be arrested by pilocarpin, which augments the secretion. In croupous conditions the loosening of the false membrane by pilocarpin has been the means of saving many lives.

All the diaphoretics, by increasing the vascularity of the skin, will hasten the appearance of the eruption in *exanthemata.* A hot bath is also useful for the same purpose. The early appearance of an exanthem is of much importance in diagnosis.

Pilocarpin is highly recommended by Robinson to arrest mercurial *salivation.* He supposes that mercury is embedded in the glands, and pilocarpin being a powerful glandular eliminant, it removes the excess of mercury. He suggests the use of this drug in cutaneous syphilides which resist mercury alone. In connection with mercury, pilocarpin augments the activity of the skin and brings the mercury to the surface of the cutaneous lesions. Pilocarpin is given in doses from $\frac{1}{32}$ to $\frac{1}{8}$ gr. two to three times a day.

Pilocarpin is practically a specific in many forms of *pruritus.* It is given in doses of $\frac{1}{8}$ to $\frac{1}{4}$ grain, and may be combined with atropin if sweating is undesirable. Many cases of pruritus ani are very much benefited by *x*-ray applications, and other cases are cured by inhibiting irritating secretions. The causes of pruritus indicate the line of treatment to be pursued. Such causes are as follows: diseases of the rectum or anus, intestinal worms or parasites, constipation, uncleanliness, and faulty diet. The *x*-rays must be used in weak doses to avoid dermatitis. The parts exposed should be about 20 cm. from the anticathode and the other structures must be protected by sheets of lead. Usually three séances are necessary, at intervals of about eight days, and usually about the fourth day some relief may be experienced.

Dry-mouth, or *xerostomia,* is benefited, according to Fraser, by holding in the mouth from time to time, for a few minutes, 5 minims of a 2 per cent. solution of pilocarpin.

DIGESTANTS.

Diastase.—An amylolytic ferment derived from malted grain, wheat, barley, oats, and rice. It is a tasteless powder, soluble in water, and 1 part will convert 2000 parts of starch into dextrin and maltose. Dose, 3 to 5 grains before meals. **Takadiastase** digests three hundred times its own weight of dry starch or ten times as much cooked bread or other like starchy food. The dose is 2½ grains. The first period of digestion in the stomach is the amylolytic, and consists in the conversion of starch into dextrin, and is effected by the swallowed saliva. Amylolytic digestion only lasts three-fourths of an hour, and is inhibited then by the presence of free hydrochloric acid. If amylolytic *indigestion* is suspected, the use of diastase, given before meals, will modify the dyspeptic disturbances.

Powdered malt (dose, 1 to 2 drams), known as malt flour, is also useful for the same purpose as diastase. A small teaspoonful of the flour sprinkled over or mixed with cooked farinaceous food assists the digestion of the latter.

Hydrochloric Acid.—The dilute acid, containing 10 per cent. of absolute hydrochloric acid, is used in doses of 5 to 20 minims, well diluted and taken through a glass tube, to avoid injury to the teeth. This drug was formerly injudiciously prescribed in all digestive troubles, on the assumption that a deficiency of the acid was present. Repeated gastric analyses have shown that in the majority of instances this acid is in excess in the gastric juice (*hyperchlorhydria*). This acid does not prevent fermentation in the stomach. In total absence of the gastric juice (*achylia gastrica*), which occurs as a neurosis or in atrophy of the gastric mucosa, hydrochloric acid, given after meals, acts as a stimulant to the peptic glands and improves digestion. In the latter affection the intestinal disturbances are improved by hydrochloric acid, but it must be given in large doses. Hydrochloric acid is usually prescribed in doses too small to be of any value. The dilute acid must be given in doses of from 15 to 60 minims. About 4.5 liters of a 0.2 per cent. solution of this acid are required to saturate about 100 grams of dry fibrin, and even this quantity is required to combine with albumin, leaving none apparent as free hydrochloric acid.

Bönninger employs the following method in the diagnosis of *gastric ulcer:* In the morning the stomach, in the fasting condition, is washed out with water, and then 100 or 200 c.c. of $\frac{1}{10}$ normal hydrochloric acid is introduced through the tube. If the stomach is normal or there is some disease other than ulcer, no pain follows the method, but if an ulcer exists, severe pain ensues, which is relieved at once by having the patient drink milk. In the foregoing test the patient's position must be changed so as to bring the fluid into contact with all portions of the stomach-wall. To decide whether a *gastric pain* is the result of hyperesthesia due to hydrochloric acid, all that is necessary is to give about 10 drops of dilute hydrochloric acid while fasting, and if epigastralgia ensues, which is relieved by sodium bicarbonate, the origin of the pain may be determined.

In *mumps*, gargling the mouth with an acidulous fluid causes severe smarting.

Many forms of *diarrhea* are gastrogenic without gastric symptoms. Here the condition is due to the absence of hydrochloric acid, which is the natural stimulus for the production of pancreatic juice.

Pancreatic Preparations.—All such preparations cannot be combined with pepsin, because they are incompatible, nor can they be effective if allowed to come in contact with the acid secretion of the stomach. *Pankreon* is pure pancreatin combined with tannin. It is a powder soluble in water, and, owing to the presence of tannin, it passes the stomach unchanged and is resolved in the intestines into its component elements. It is evident, for the reason cited, that pankreon should be used to the exclusion of other like preparations. If the symptoms of intestinal indigestion are controlled after the use of the latter, we may have reason to suspect a qualitative or quantitative change in the pancreatic secretion. There are functional disturbances of intestinal absorption which are distinguished by Salomon[65] from like disturbance in pancreatic disease by the fact that in the latter pankreon is of benefit, while in the functional disturbances the fat continues to be passed in the stool after a normal diet (*vide* Chapter VII). *Infantilism* is a condition associated with a loss or perversion of the internal secretions, resulting in an arrest of development, and the individual remains a child mentally and physically. Among the forms noted are: (1) The myxedematous, due to thyroid inadequacy; (2) the Lorain type, due to hereditary syphilis, and (3) pancreatic infantilism, described by Byron Bramwell as retarded development associated with chronic diarrhea. One of his patients made a remarkable gain in two years after the use of pancreatic extract. It was supposed at one time that *diabetes mellitus* was provoked by a deficient internal secretion of the pancreas, hence pancreatic preparations were largely employed in this disease; but the results have not been good, probably because all forms of diabetes mellitus are not of pancreatic origin. The use of pankreon may assist us in distinguishing pancreatic diabetes from the other forms, and it may be suspected by the presence of fatty stools, by its rapid and severe course in young and middle-aged subjects, and when polyuria is infrequent or absent.

Pepsin.—The therapeutic value of this agent being reasonably questioned, it can prove of no value in diagnosis. Baron Liebig once observed, "Nature refuses to be made the handmaid of chemistry." Sollmann has recently shattered another therapeutic fetich, the polypharmaceutic "digestive elixir." He demonstrates experimentally that liquid preparations containing more than one digestive ferment are mutually incompatible in solution, and that one elixir—"the only true digestant," because it contains the enzymes of all the glands which are necessary for digestion—possessed no enzyme activity whatever.

DIURETICS.

These drugs increase the flow of urine and act in various ways: (1) By augmenting blood-pressure, increasing vascular fullness, stimulating the action of the heart, and by constriction of the peripheral vessels through the vasomotor system (cold to the surface). The foregoing act as cardio-vascular diuretics. (2) By dilatation of the renal arteries, thus increasing the amount of blood within them, without necessarily influencing the pressure in the arterial system. (3) By a direct and specific action on the renal epithelium, *e. g.*, calomel, lactose, and pilocarpin.

Many diuretics only increase the elimination of the fluid but not the solid constituents of the urine. Such drugs are caffein, digitalis, and strophanthus, whereas pilocarpin increases the elimination of urea. There are drugs not acting specifically as diuretics which augment the excretion of the waste products, *e. g.*, salicylates and colchicum, urea and uric acid, thyroid extract, nitrogen, and phosphates.

The kidneys are the chief organs for the elimination of solid waste products. Usually when the quantity of urine is increased the solids are correspondingly diminished, and vice versâ. Yet the solids may be eliminated independently of one another. Thus the excretion of urea is dependent on the quantity of blood flowing through the kidneys, whereas the elimination of sodium chlorid bears no relation to this blood-flow.

Diuretics in Diagnosis.—Three special objects are achieved by diuretics: (1) The removal from the blood of excrementitious matters; (2) hastening the absorption and excretion of dropsical effusions; (3) diminishing irritation of the genito-urinary tract by means of saline diuretics, which also render the urine alkaline. If *digitalis* causes diuresis, we may conclude that the diminished flow of urine prior to its use was caused by a failure in the circulatory apparatus, because its effects are secured by its stimulating action on the heart and blood-vessels. On the contrary, if drugs like theocin, diuretin, and calomel are effective, we conclude that the effects are not attained by stimulation of the circulatory apparatus, but by direct action on the renal epithelium. It is quite evident that in *renal disease* further irritation by means of the direct diuretics of the already involved cells is dangerous. In renal disease, especially the acute forms, diet and augmentation of the vicarious emunctories (skin and bowels) will rest the kidneys and thus indirectly promote diuresis. Similarly, rest in bed will aid diuresis in cardiac disease, because the heart is rested and its influence on blood-pressure becomes manifest. The excretion of urine bears a definite relation to the condition of the cardiac muscle (*vide* Digitalis and Chapter VI). *Passive congestion* of the kidneys occurs in chronic diseases of the heart or lung, and a urine small in quantity and of high specific gravity, with casts, albumin, and blood-corpuscles, is excreted. While there may be a coexisting nephritis, the rule is that the renal congestion is alone responsible for the urinary condition, and that the use of diuretics which will increase the rapidity of the renal blood-current will improve the condition. Digitalis is the ideal diuretic for this purpose. In such congested kidneys latent uremic symptoms are associated with the cardiac disease, and by the use of diuretics the symptoms in question may be referred to their proper origin. We know that *mental symptoms* are often associated with heart disease, and that delirium, hallucinations, and morbid impulses (suicide) may occur. Whereas such symptoms may occur in the stage of compensation, they are more frequent when the latter is broken, and I have frequently noted their evanescence after the action of diuretics. In some *cardiac* and *renal diseases* the tissues are waterlogged. Let us suppose that on auscultation of the lungs we hear râles. The latter are often infrequently referred to a coexisting bronchitis, whereas in reality they are caused by pulmonary edema. At any rate, their evanescence after the use of digitalis, which improves the circulation and causes diuresis, may prove their origin.

A *dullness* dependent on fluid may be determined by the use of diuretics. After defining the level of the fluid, say, in the pleura or pericardium, diuretics are given. If the latter are effective, any change in the previous level of the dullness by percussion would speak for a dullness dependent on fluid. Even a little point like the foregoing is not to be ignored, say, in the differentiation of acute heart dilatation and a pericardial effusion, which is conceded to be at times a difficult matter.

In *obesity* diuretics may assist in diagnosis. In this condition the amount of urine excreted is diminished in proportion to the fluid ingested, and this is explained by the augmented excretion of sweat in the obese subject, but it can be traced more often to cardiac insufficiency, the result of fatty degeneration of the heart. Edema and adipositas are frequently associated, and a cutaneous edema may be misinterpreted as fat. The increased weight of many obese individuals is dependent on the waterlogged condition of the organism, and the reduction in weight in such instances, following the use of diuretics, gives us some information respecting the accumulated fluids. I have frequently failed to reduce many obese subjects by diet alone, and it was only after the use of digitalis that I succeeded. Thus digitalis also guided me in limiting the ingestion of fluids in the further treatment of such subjects.

The finding of *casts* in the urine is an important index of renal disease. Their microscopic detection is not always easy when the urine is passed in large quantities. When I desire to search for them, I diminish the quantity of fluid ingested, and as a result I obtain a concentrated urine which will show the presence of casts and epithelial cells to better advantage.

Caffein.—This drug is as an effective diuretic by its direct action on the renal epithelium. It may give rise to a slight and transient glycosuria. It is usually given in combination with digitalis with better results. It must be avoided in nephritis, owing to its irritant effects on the renal epithelium. *Caffeinæ sodio-benzoas* (5 to 10 grains) is usually prescribed.

Calomel.—This acts by direct irritation of the renal epithelium, hence its use presumes healthy kidneys. It often acts when other diuretics fail, and is quite independent of cardiac vigor. It is indicated in all serous effusions, whether of hepatic, cardiac, or renal genesis. One must take all the usual precautions against salivation. It may be given alone or in combination with digitalis in ½-grain doses, three times a day, and to check its purgative action it may be combined with small doses of opium. Calomel diuresis may not show itself until the fourth day, and if it does not, it is better not to persist with the remedy.

Digitalis.—The action of this drug has been referred to elsewhere.

Diuretin.—This drug is closely related in action to caffein, without the action of the latter on the nervous and circulatory systems. It is more effective in combination with digitalis and possesses a very favorable action in angina pectoris. The dose is 10 to 20 grains three times a day in capsules or solution. The full action of the drug as a diuretic does not occur until the third day. The untoward effects, if any, are headache and gastric disturbances, due, no doubt, to its salicylic acid constituent. Buch regards diuretin as a specific in *arteriosclerotic abdominal colic.* Given in doses of 15 to 20 grains, three times a day, it will entirely alleviate or relieve the attacks, especially if supplemented by rest in bed. Paroxysmal abdominal pain, notably after exertion or emotions, suggests intestinal arteriosclerosis, if occurring after the age of forty (Cheinisse). *Tinct. strophanthi*, 5 to 8 drops, three times a day, has a like specific effect. No other form of abdominal colic is thus amenable to these drugs, hence the success is pathognomonic of arteriosclerotic colic. The attacks may last only a few minutes, but exceptionally fifteen to thirty minutes. The abdominal aorta is usually sensitive to pressure, but continued moderate pressure relieves the pain. There are concomitant symptoms of arteriosclerosis and there is always an accentuation of the second aortic sound. The subjects are well nourished and even corpulent. The attack of colic generally wakes the subject from sleep.

Lactose.—This is given to substitute an essentially milk diet for diuretic purposes. It is an efficient drug, especially in cardiac dropsy. About 2 to 4 ounces may be used daily, dissolved in milk.

Saline Diuretics.—To this group belong the salts of potassium, sodium, lithium, calcium, and magnesium. The salts of potassium are preferred, however, as diuretics, and also neutralize an excess of acid in the urine. The saline diuretics are inefficient when the blood-pressure is low, because their action is a direct one on the renal epithelium. This class of diuretics is efficient in removing morbid accumulations of serum, but in cardiac disease when the blood-pressure is low they must be combined with cardiac tonics. In *renal disease* they should not be used, for with the renal epithelium already involved in inflammation, further irritation may precipitate an attack of uremia. I recall a patient seen in consultation who had a series of uremic convulsions complicating nephritis. These attacks had lasted ten days. When the saline diuretics were discontinued the attacks ceased, and the albumin present in the urine in large quantities rapidly disappeared.

As diuretics, the *acetate* or *citrate of potassium* may be given in doses from 15 to 60 grains.

To determine whether dysuria, frequency of micturition, and other symptoms are caused by an *excessive acidity* of the urine, the alkaline diuretics should be tried. If later, notwithstanding the alkaline reaction of the urine, the symptoms do not abate, we are justified in concluding that the excessive acidity of the urine is not concerned in the symptoms. In pruritus of the genitalia this test should be tried. If the symptoms are caused by ammoniacal fermentation of the urine, try *helmitol.* According to Sollmann, to produce alkalinity of the urine 7 gm. of sodium carbonate or 15 gm. of sodium acetate are required per day.

Theocin.—This is unquestionably the most powerful and rapidly acting diuretic we possess, and is specially indicated when we wish to quickly remove accumulations of fluid. Its action is, however, not as durable as diuretin. It may cause headache and gastric disturbances. *Theocin sodium acetate* is usually prescribed, on account of being more soluble than theocin alone, in doses from 5 to 8 grains.

Ordinary diuretics, according to the observations of Meyer, do not increase the *polyuria* in either polydipsia or in diabetes insipidus.

According to the communication of Schäfer and Herring to the Royal Society, it appears as if the **pituitary extract** has a greater diuretic activity than any other preparation, and it acts on the vascular system as well as by stimulation of the renal epithelium.

EMETICS.

Apomorphin Hydrochlorid.—This acts most effectually as an emetic when given hypodermatically. After the injection of an average adult dose (gr. $\frac{1}{10}$), vomiting usually occurs within ten minutes, and very often without being preceded by nausea or other symptoms. Vomiting may occur but once or several times. Depression is slight, although occasionally intense collapse has followed. This drug is indicated when the patient cannot swallow, when immediate effects are desired, and when one wishes to avoid the action of direct emetics on an inflamed stomach. Fresh tablets and solutions should only be employed, as they deteriorate with age and exposure to light and air. In experimenting with apomorphin, the writer has found that it is often more easily absorbed by the nasal than by the gastric mucosa. The drug in question is also valuable as a sedative and hypnotic, given by hypodermatic injection in small doses ($\frac{1}{30}$ grain).

Ipecacuanha.—This drug is suitable for children, as the syrup or wine, in doses of from ½ to 2 fluidrams. The action of this drug is mild even in large doses, and the incidental phenomena attending its use are unimportant. Like the majority of emetics, however, it augments the flow of saliva and sweat, produces giddiness, rapid pulse, and a weak and drowsy feeling. With all emetics large draughts of water hasten the emetic effects. In adults we give 10 to 20 grains of the powder mixed with sugar every ten minutes until vomiting occurs. In old and feeble patients emetics must be used with discretion to avoid collapse symptoms. For the average patient vomiting is quickly induced for diagnostic purposes by titillating the fauces with the finger after the patient has drunk several glasses of warm water. Ipecacuanha is regarded as a specific for *dysentery* in the tropics, but the saline treatment of this affection furnishes the best results. Thus, Buchanan treated eight hundred and fifty-five cases, with only nine deaths; and Day, with the opium and ipecacuanha treatment, had a mortality of 32 per cent., and a mortality of only 2 per cent. by the saline treatment. The latter treatment is rapid in its results, and consists of giving sulphate of magnesium (2 drams) or Rochelle salts (½ oz.) dissolved in water every hour until copious purgation occurs, after which opium is used.

I have frequently brought attacks of *hysteria* to a speedy issue by a hypodermatic injection of apomorphin, and have thus established the nature of the paroxysm. The stomach is a much abused organ, and the singular feature of it all is that the patient does not realize it, and the physician often does not suspect it, and varied phenomena may arise even without dyspeptic symptoms. The latter fact must be specially emphasized. Thus it is that patients will tell us of paroxysms of headaches, acute abdominal pains, and comatose states, and mothers will tell us of convulsive-like attacks from which their children suffer, with never a word of dyspeptic symptoms at the time nor in the paroxysmal intervals. At Rome, in the palace of the Cæsars, there is a small room next to the banqueting hall where the Romans emptied their stomachs when they could eat no more, and, having accomplished this act, they finished the feast. We may not desire to emulate them as Sybarites, but surely we must admire their wisdom. Some years ago I was consulted by a gentleman who informed me that he had symptoms of transient unconsciousness, and that several physicians had regarded him as a "mild epileptic." Large doses of the bromids had failed to subdue the attacks. I asked him to call me when he had a paroxysm. When I called, vomiting was induced by titillating the fauces, and although eight hours had elapsed after eating a heavy dinner, the vomitus consisted of a prodigious quantity of undigested food. A simple regimen sufficed to cure the patient, and for ten years, up to the time I last saw him, he never had another attack. Now, this patient, like many others whom I see, never complained of dyspeptic symptoms. I could cite numerous instances like the foregoing of headaches, abdominal pains, etc., variously diagnosed, which revealed their origin by an examination of the vomitus. Now, there are many patients who object to the use of the stomach-tube after you have given them a test-meal. I tried the tube on myself once, and ever since I am less intolerant to such objections. In such instances a hypodermatic injection of apomorphin or the use of the finger in the fauces suffices to give us enough of the stomach contents for examination. Naturally, no water must be ingested by the patient, for we want the undiluted contents.

The true origin of some cases of asthma (*asthma dyspepticum*) is revealed by emesis, the relief being immediate. However, conclusions must not be formulated hastily. I was once called to see a physician whose attack of asthma was controlled at once by an emetic, but in the expectoration there were fibrinous casts. My patient had fibrinous bronchitis, and an overloaded stomach was merely a predisposing factor.

Solid bodies may be removed from the pharynx, esophagus, or upper air-passages by the use of an emetic. One must remember, however, that if the body is in the trachea, danger may ensue by its becoming lodged in the glottis. Vomiting or emptying of the stomach by means of a tube relieves the characteristic attacks of colic caused by *pyloric stenosis*.

GASTRIC ANTACIDS.

Hyperacidity (hyperchlorhydria) of the gastric juice is common in the dyspepsia of neurotic individuals. Acid eructations and burning in the epigastrium are frequent symptoms at the height of digestion. This excess of acid may occur periodically (gastroxynsis), and is quite independent of the ingestion of food, or it may be a continuous secretion. Now, pyrosis is regarded as a constant symptom of a too acid gastric juice, but this is wrong, for this symptom may be present with a neutral reaction of the stomach contents.

Sodium bicarbonate, by neutralizing the action of the acid, gives immediate relief to the symptoms if caused by hyperchlorhydria. Thus one may often determine the character of acute gastric symptoms. Calcined magnesia and prepared chalk are often more efficient because of their greater saturating power. When the sodium bicarbonate is used, much carbonic acid is evolved, and may cause temporary distress by distending the stomach. With calcined magnesia there is no evolution of carbonic acid. The usual dose of sodium bicarbonate is wholly inefficient for either diagnostic or therapeutic purposes. Even 60 grains would prove a moderate dose. One must not invariably conclude that, because pain ceases after the administration of an alkali, it is caused by hydrochloric acid, insomuch as the mere expulsion of gas brought about by the alkali will relieve pain. If in doubt, the use of compound spirit of ether, which is not an antacid, will aid in deciding the question. The use of a gastric antacid is often more efficient in diagnosis than the method of determining the acidity by analysis of the stomach contents, for the reason that the percentage of acid is no index to the tolerance of the patient, for the latter may have no symptoms even though the percentage of acid is in excess of the normal. Free hydrochloric acid is not present in the stomach until three-quarters of an hour after the ingestion of food, and at this time amylolytic digestion is inhibited because the digestion of starch cannot proceed in an acid medium. Now, if just before the ingestion of food we give the dyspeptic, say, 60 grains of sodium bicarbonate, and no gastric distress follows, presuming that it usually follows, we may conclude that the sodium has inhibited the premature presence of free acid and thus enabled starch digestion to proceed to completion. Some conclude that the symptoms of hyperchlorhydria are provoked by a hyperesthesia of the nerve-endings in the gastric mucosa, and that the latter is cured by alkaline remedies, even though hydrochloric excess may persist. According to this theory, sodium bicarbonate exerts a sedative influence upon the irritated mucosa. According to this theory, Campo[68] uses the following: menthol, 7½ grains; cocain hydrochlorid, 7½ grains; and alcohol, 160 minims. From 5 to 10 drops given at the onset of distress afford greater relief than that experienced from the use of alkalies. It is evident that the use of the foregoing will prove of little value in diagnosis, because it would afford relief from gastric distress irrespective of cause; hence its use must be limited in differentiating gastric from other forms of abdominal pain. In *duodenal ulcer* the pain occurs several hours after food is taken into the stomach, a time when the acid chyme attains the duodenum. Alkalies, by neutralizing the acid in the stomach, will diminish the severity of the pain. Alkalies, if not absorbed or neutralized before reaching the intestine, favor intestinal digestion by increasing the alkalinity of the secretions.

Calcium carbonate (**chalk**), which is insoluble, is specially adapted for the latter object. When catharsis in addition to neutralization is desired, magnesium (carbonate or oxid) may be given. Many intestinal troubles, as well as the *summer diarrhea of infants*, are caused by excessive acidity, and here the gastric antacids prove diagnostic and curative.

There are patients who will not submit to the use of the stomach-tube, and Benedict[69] suggests an external method of testing for *gastric acidity*. Have the patient take an Ewald test breakfast, which consists of an ordinary stale roll and about ⅔ of a pint of fluid (water or weak tea without sugar or milk). One hour after, give the patient a teaspoonful of sodium bicarbonate in water, and then directly afterward auscultate over the stomach to note if much bubbling from the disengagement of carbonic acid has resulted, and percuss to determine if there is any increase in the tympany. Normally only a moderate amount of effervescence occurs (crackling and bubbling sounds) and percussion shows only a small amount of tympany. The occurrence of the sounds shows that there is some free acid in the stomach, and when these sounds and tympany are increased, one may infer an excessive secretion of hydrochloric acid. Now, this test may not be positive, because the acid need not necessarily be hydrochloric. The advocates of this test claim, however, that if acids other than hydrochloric are present, we have the following invariable concomitants when organic acids produced by fermentation are present: furred tongue, bad breath, poor appetite, eructations, and gaseous distention of the stomach—

symptoms which are usually absent when the percentage of hydrochloric acid is normal or excessive. Reed[70] extends the foregoing method as follows: the stomach area of resonance by percussion is noted, after which the patient swallows the soda solution. After a few minutes, if percussion shows an increased area of resonance, the percentage of hydrochloric acid is either normal or excessive. If no tympany nor even a moderate increase of resonance results, the patient receives about 10 drops of strong hydrochloric acid in solution, and then, if on auscultation bubbling sounds are heard and there is an increase of epigastric resonance, one is able to verify by this chemic test what has been shown by the first test, viz., that hydrochloric acid is absent or deficient.

Diabetes.—In the coma of this disease it is now assumed that acid poisoning is the cause of the trouble, and Magnus-Levy has shown that the alkalinity of the blood is diminished. It is also true that alkaline treatment is indicated, and that the latter would prove more efficient if employed more heroically. Thus, Sollmann suggests 40 grams of sodium carbonate a day before coma sets in, and if the latter is present, 100 or 200 grams. In my experience, coma is not the only symptom of acid intoxication. Many complications of this disease will yield to large doses of sodium carbonate. The latter fact is important in diagnosis and treatment. In the presence of a diabetic complication, I make the test for diacetic acid in the urine, viz., a few drops of chlorid of iron solution produces a Bordeaux-red color. Even though the latter reaction is absent, alkalies should be employed nevertheless.

Urinary Acidity.—Urinary symptoms may arise from either a morbid alkalinity or acidity. It is often necessary to render the urine acid in phosphaturia and when there are alkaline concretions. This object is best effected by benzoic acid and its salts. The salts of potassium are more active than the sodium salts in neutralizing or diminishing the acidity of the urine. If potassium bicarbonate is given on an empty stomach, it is apt to render the urine more acid by forming an acid phosphate of sodium, hence it must be given on a full stomach, where it is decomposed by the acid of the gastric juice. *Phosphaturia* is most often an alkalinuria, and suggests usually an alkaline urine rather than an increased production and excretion of phosphates. Harrison notes that the spontaneous occurrence of phosphaturia is frequently associated with the disappearance of gleety affections, and he suggests that the administration of alkalies (potassium bicarbonate) to produce phosphaturia, which must be maintained for some time (local treatment suspended), in chronic urethritis will frequently lead to successful results.

Toothache is said to be caused by the presence of acid in the carious tooth, and that the application of a solution of sodium bicarbonate will at once arrest the pain. Aching of the teeth dependent on retracted gums is said to be equally relieved. Brunton suggests an alkaline treatment externally and internally for *furuncles* associated with sharp, stinging pains. The latter, he assumes, are caused by diminished alkalinity of the blood. He also claims that neuralgia and other pains respond to the alkaline treatment. In *bronchitis* and *bronchopneumonia* Haig advises the use of bicarbonate of soda in sufficient quantity to make the urine alkaline. If this drug is effective, there is an immediate fall of temperature and speedy resolution of symptoms.

Bismuth subnitrate, as shown by Hayem (who gives daily doses of 20 grams), is the remedy *par excellence* in the various forms of *gastric pains* and reflex gastric phenomena (spasms, vomiting, eructations). It is impuissant in algias which have a central point of departure, as in the gastric crises of tabes, and is equally inefficacious in the pains of a toxic gastritis and in stenoses following ulcers.

HEMOSTATICS.

Calcium Chlorid.—This agent increases the coagulability of the blood. According to Wright, who first directed attention to its action, the best results are attained by giving it in doses of from 3 to 10 grains, three times daily, for three days, and then omitting it for the same period. It is irritating to the stomach; hence it must be administered after meals, well diluted. It is more palatable made into pills with syrup. Dose, Calcii lactas or Calcii chloridum, 5 to 15 grains.

Coagulability of the blood is[71]:

Increased by—	Diminished by—
Carbonic acid,	Oxygen,
Calcium chlorid or lactate,	Alcohol,
Milk,	Restriction of food,
Magnesium carbonate.	Diminution of lime salts,
	Large quantities of fluid,
	Citric acid,
	Rhubarb,
	Acid fruit juices,
	Acid wines,
	Tobacco smoking.

Serum.—Weil, of Paris, has shown that ***hemorrhagic dyscrasias*** are ameliorated by the sera of man, the horse, rabbit, and cattle. He injects 30 c.c. beneath the skin. The ordinary antidiphtheria serum is of equal value when it is less than two weeks old.

Pathologic variations in the ***coagulation-time of the blood*** are dependent on so many external conditions (temperature, shape of vessel in which coagulation occurs, amount, etc.) that it is difficult to determine constant normal figures. Reference has already been made (page 151) to two methods of determining the coagulation-time of the blood. There are a number of pathologic conditions characterized by a lowered coagulability of the blood, dependent, as a rule, upon a deficiency of the salts of calcium in the blood. It is evident, then, that the exhibition of anything which will increase such coagulability is of importance in diagnosis and treatment. The calcium salts are admirably adapted for such an object. It is important to estimate the coagulability of the blood before treatment, as, if this is not deficient, no results can be expected from the salts. According to Ross,[72] there is a certain ***headache*** frequently occurring in women, and occasionally in men, which presents the following characteristics: (1) It is most severe on waking and disappears within six hours. (2) It is dull, heavy ache or a frontal or temporal throbbing. (3) It is of several years' duration and very intractable. It shows itself as the common occasional headache to which many people are subject. (4) It is associated with a deficient coagulability of the blood. The subjects are of the lymphatic type with heavy and listless expression and eyes which are often puffy. Some anemia is the rule. There is mental and physical lassitude, and often anorexia, nausea, pain after food, constipation, dyspnea, palpitation, and hemic murmurs, and all degrees of mental depression. In these cases the lactate is preferable to the chlorid salt, as the latter is unpalatable, nauseating, and may not be absorbed. The following mixture is advised: Calcium lactate, 15 grains; tincture of capsicum, ½ minim; chloroform water, 1 ounce: this dose is given three times a day. The lactate may be given alone as a powder dissolved in water. The dose of the chlorid is the same. In a number of cases relief is experienced within twenty-four hours, and in nearly all the headaches disappear after the fourth day. The salt should be given for three weeks in mild, and for six weeks in severe, cases. For the relief of the occasional headache, ½ dram of calcium lactate is usually successful within one hour. Professor Wright has investigated the pathology of chilblains, urticaria, certain edemas, and physiologic albuminuria, and has shown that the pathologic basis of these conditions is diminished coagulability of the blood. The tendency of the plasma to pass into the lymph-spaces he calls "*serous hemorrhage.*" Now, in urticaria and chilblains the calcium salts often act favorably. As a therapeutic test in a negative direction, it has been found that headaches and chilblains relieved by calcium salts may be precipitated by giving potassium citrate.

Neuralgias and *migraine* may likewise be caused by diminished coagulability of the blood. The headache and edema in chronic nephritis may also be benefited by calcium salts.

Menorrhagia dependent on diminished blood coagulability is amenable to treatment by the calcium salts.

Orthostatic Albuminuria.—This form of albuminuria is now generally admitted as a morbid entity which may be present in children and adults. The subjects are usually pale, have frequent headaches and a feeble constitution. When such subjects walk or run, albumin appears in the urine and disappears after rest in bed. No definite renal lesions have been demonstrated to account for this condition. Kraus[73] adopts the following method of differentiating orthostatic from albuminuria dependent on renal lesions: the subject is given calcium lactate (usual dose) for two days in succession, and if it is orthostatic, the albumin will disappear, whereas if renal lesions exist, it will persist. The orthostatic form, according to Kraus, is caused by diminished coagulability of the blood, and the calcium, by augmenting this coagulability, causes the albumin to evanesce.

Langstein[296] found in the urine of patients with orthostatic albuminuria an albuminous body which is precipitated by acetic acid. Thus when this body is found, a differentiation is possible from chronic nephritis, although, the writer states, it may be present in the chronic nephritis of children, but always in smaller amounts than ordinary albumin. The body in question is detected as follows: Two test-tubes are filled to the same height with urine, a few drops of dilute acetic acid are added to each, and the tubes are shaken for several minutes. The specimens are then diluted with three or four volumes of water, and to one of them a few drops of potassium ferrocyanid solution are added. On holding the tube against a black background the presence or absence of the acetic acid albumin in the one tube can be determined, and its bulk may be compared with that of the total albumin in the other. The addition of water after acidulating is necessary in order to prevent the precipitation of uric acid from a urine of high specific gravity. The nature of this albuminous body is still uncertain, but it appears to resemble that which von Leube discovered in about two-thirds of a large number of healthy soldiers after moderate exertion.

Iscovesco reported to the Biological Society, February 23, 1907, that patients suffering from Bright's disease of the non-polyuric form, but who passed from 3 to 15 grams of albumin per liter, showed a diminished excretion of the latter after the use of chlorid of calcium by the mouth in doses of from 20 to 75 centigrams per diem. The general health was correspondingly improved. In the opinion of the writer, albuminuria is dependent on a renal and a blood factor, and when the renal factor is implicated calcium chlorid is without influence on the excretion of albumin.

According to the observations of Rénon,[350] it appears as if calcium chlorid were almost as efficacious in forms of albuminuria other than orthostatic. In one-half of his cases albuminuria was notably benefited, in one-fourth of his cases a complete disappearance of albumin in the urine was noted, and in the remaining fourth no results were noted. In several rare instances it even appeared to augment the albuminuria. The foregoing results were attained by the medicament only. The remedy is first employed in small doses, and if no effects are observed, the dose is augmented. If no effects are noted after one month, it is useless to persevere with the drug.

It is interesting to note the observations of Jehle in orthostatic albuminuria of infants. He observes that when the little subjects are so bandaged that the body is bent forward, thus exaggerating the curvature of the back, no albuminuria ensues, but the latter invariably follows when the child is permitted to assume the erect posture after removal of the bandage. He assumes that the enfeebled lumbar musculature causes a lumbar lordosis which is responsible for the albuminuria. This lordosis is most pronounced at the first and second lumbar vertebræ, whereas the physiologic lordosis is located at the third and fourth lumbar vertebræ.

More recently Wright and Paramore[212] have shown that magnesium carbonate will likewise shorten the coagulation-time of the blood. They also show that *urticaria* following the use of soap enemata or after the ingestion of the oxalic acid from rhubarb or the acids from sour fruits, fruit juices, and wines, is due to the absorption of decalcifying agents which diminish blood coagulability. This view explains the rationale of giving magnesium carbonate in the so-called "decalcification urticarias." It has been suggested to give lime salts hypodermatically, but in so doing there is always danger of coagulation necrosis at the site of injection. Netter[271] has shown that if calcium chlorid is given by the stomach in one-gram doses on the day of an injection of *diphtheria antitoxin*, the eruptions caused by the injections could be inhibited in the great majority of the cases. Wright demonstrated that the *serum disease* caused by the use of foreign serum of any kind, and characterized by urticaria and articular pains, was due to a diminution in the coagulability of the blood, and that calcium salts appeared to have a preventive effect.

The investigations of MacCallum show that the *parathyroids* control calcium metabolism. It has been shown previously that muscular twitching could be produced by precipitating the calcium. All the symptoms (muscular twitching, tachypnea, etc.) produced by parathyroidectomy may be instantly cured by intravenous injections of a 5 per cent. solution of calcium lactate. Subcutaneous injections or doses given by the mouth are equally effective, but act more slowly. These results lead MacCallum to conclude that the calcium salts will be equally effective in the various forms of *tetany*.

HYPNOTICS.

The Theories of Sleep.—The *anemic theory* supposes that during sleep there is a decreased amount of blood in the brain. Let us consider some of the peculiarities of the cerebral circulation. Immediate loss of consciousness follows if the brain is not always supplied with blood, hence four large arteries supply blood, which anastomose in the circle of Willis. Inclosed in a rigid cranium, the volume of blood in the cerebral vessels cannot change unless the volume of the other cranial contents alters in the opposite sense. The opinion which prevailed at one time, that the quantity of blood in the brain must be the same at all times, has been confirmed by recent investigations.

The arteries are muscular, and are probably supplied with vasomotor nerves. However, these nerves functionate feebly, for the cerebral circulation passively follows changes in pressure in the aorta and vena cava. When the vessels of the splanchnic area suddenly dilate in consequence of fear or shock, fainting occurs, because the cerebral flow has ceased, and the blood by its own weight sinks into the splanchnic vessels. Changes in the general circulation influence the velocity, but not the volume, of blood in the brain. A rise in the aortic pressure with a constant pressure in the vena cava increases the arterial and diminishes the venous blood, with increased velocity of flow. With increased vena cava pressure, aortic pressure remaining constant, there is less blood in the arteries, more in the veins, and a diminished velocity of flow.

The *toxic theory* of sleep supposes that, in consequence of the wear and tear of the body tissues, waste products are generated which anesthetize the brain-cells, which preside over the senses. Nitroglycerin causes brain hyperemia, yet despite the anemic theory of sleep, I have used this drug with benefit in some cases of persistent insomnia. It is possible that the action of this drug can be explained by supposing that it washes into the blood-stream fatigue products which have accumulated in certain parts of the body.

Overton's recent studies concerning the action of narcotics show that they are dependent on chemic and in part on physical conditions of the cells. The richer a cell variety is in contained fats, the more narcotic will it absorb. Weichardt has shown that simultaneously with the production of fatigue poisons, anti-fatigue poisons are produced, which, when injected into animals, produce fatigue, reduction of temperature, and drowsiness. The value of sleep depends more on its intensity than on its duration. Thus, eight hours of a disturbed, dreamy sleep are barely the equivalent of two hours of a deep, dreamless sleep. For this reason we can understand why men of the greatest mental activity are usually the briefest sleepers. Frederick the Great required only five hours sleep, and Pitt only three hours. The length of time a person can live without sleep is about three weeks. When the Chinese wish to punish a criminal, they deprive him of sleep, and he usually dies within a fortnight from the time the punishment begins.

Causes of Insomnia.—Professor See divided all causes of insomnia into psychic and physical. The *psychic form* is provoked by mental emotion, thought, worry, and other causes not directly dependent on organic disease. Young, the well-known author of "Night Thoughts," was presumably thus afflicted:

"From short as usual and disturbed repose,
I awake. How happy those that wake no more;
I awake emerging from a sea of dreams
Tumultuous, where my wrecked despondent thought
From wave to wave of fancied misery
At random drove, her helm of reason lost!"

The worries of the student, the merchant, the speculator, homesickness, and disappointment are of this order. In instances like these, mental medicine for a mental disease is indicated:

"Who shall minister to a mind diseased;
Pluck from the memory a rooted sorrow,
Raze out the written troubles of the brain,
And with some sweet oblivious antidote
Cleanse the stuffed bosom of that perilous stuff
Which weighs upon the heart?"

Physical Causes.—Every deviation of health is characterized by disturbance of sleep, but in most cases where a vicious habit is established, it tends to persist. Among the chief causes are: (1) Brain strain; (2) organic diseases of the brain and arteries; (3)

stomach and intestinal diseases; (4) irritation of the sexual organs; (5) poisonous substances (toxic insomnia).

Dreams.—Whereas in deep sleep consciousness appears to be in abeyance, in less pronounced sleep states mental processes are actuated, consciousnesses are generated, and the brain communicates with the outside world—in other words, we dream. Our most vivid dreams occur prior to sleep or just before waking.

Dreams are the product of stimulation of some sense-organ. When the eye, ear, or an internal organ has been stimulated, the brain, in accordance with the law of habit, proceeds to work somewhat like in the waking state, but in the dream state dream ideas are incongruous, fantastic, and disorderly, because the associated ideas have no guiding purpose, and there is no voluntary control over the current of thought. Dreams are accepted as real because there is absolute loss of attention during sleep and ideas run rampant because attention is not selective. According to the sense stimulated, so we dream; thus, one may dream in visions, sounds, or in temperatures if the skin is stimulated. Sleep intensifies imagination and converts the brain into a susceptible organ of suggestion, for then reason and judgment, which inhibit brain automatism, are no longer in command, and the idea accepted as real is converted into action (ideomotor action). Tuke cites the instance of a girl who desired to use rhubarb on the following day, which she disliked; that night she dreamed she had taken it, and on the following day had a number of evacuations. Demangeon tells of a monk who desired to purge himself on a certain morning. On the previous night he dreamed he had taken the medicine, and, awaking, found that he was compelled to evacuate his bowels a number of times. Like nightmare, dreams are frequently associated with some digestive disturbance, and the toxic substances present in the blood stimulate ideas and emotions. Milton, referring to Adam, said, "For his sleep was very light, from pure digestion bred."

Hypnotics in Diagnosis.—Many methods are employed which are not hypnotics in the strict sense of the word, yet indirectly they combat insomnia, and are for all practical purposes hypnotics. If the physician will thoroughly investigate visceral sufficiency (*vide* Chapter VI), the routine practice of prescribing the conventional hypnotics will be very much limited, on the principle that drugs have been invented for both the patient and the physician. They relieve the former of obeying the laws of hygiene and the latter of inculcating them; and they abet the automatic, in lieu of the rational, practice of medicine. It has been truly said that if sleep and hope should be taken from man, he would be the most miserable being in existence. Much can be obtained by obeying the laws of hygiene. Attention must be directed to a minute investigation of all the bodily functions to ascertain the fundamental condition, of which insomnia is a mere manifestation. We possess many drugs which, when prescribed with discretion, may be regarded as harmless; yet drugs should only be used as a last resort, for any drug which induces sleep by overpowering the body is not entirely without danger.

Generally speaking, an adequate amount of physical exercise is necessary in all sufferers from insomnia. Nothing is more conducive to sleep than exercise taken in the open air. Some diversion for the brain-worker may be found in change of scene and society. "Seeing that too much sadness has congealed your blood, and melancholy is the nurse of frenzy, therefore, have thought it good for you to hear a play, and frame your mind to mirth and merriment, which bars a thousand harms and lengthens life." No detail should be neglected in ascertaining the cause of insomnia. Tea or coffee should not be taken at the evening meal, and tobacco should not be used, at least some hours before retiring. A glass of warm milk or a cup of hot bouillon before retiring may prove beneficial in inducing sleep. Some induce sleep by taking a glass of beer or malt extract before retiring. If the sufferer from insomnia be a student or literary man, all intellectual effort should be stopped at least an hour before retiring, and the interval filled in with some extraneous dull reading. When this fails, no intellectual work should be done after supper, reserving that work for the early morning hours. Some cases of insomnia yield only after a complete change of scene, free from excitement and sight-seeing. Some exercise before retiring and a tepid or a warm sponge bath, conduces to sleep. Climate is an important factor, but this is a matter of idiosyncrasy: some prefer the soothing effects of a warm, and others the stimulating effects of a cool, climate. Some prefer the seashore; others, mountainous districts. Many hydrotherapeutic methods and different forms of massage and electricity have their advocates, but we would be carried too far to consider such methods in detail.

One should make the environment suggestive of sleep—a well-ventilated room, cool, dark, and quiet; a comfortable bed with a moderate amount of covering. Habit is an important factor in sleep, and the patient must be admonished to retire and awaken at a certain hour. Above all, the senses must be inhibited. Strümpell cites the following observation: A young man had lost all power of sensation except in the right eye and the left ear. When the former was covered with a bandage and the latter stopped by a plug, the brain of the subject was practically isolated from the outer world, and the invariable result was genuine sleep.

In carrying out ***hypnotic suggestion*** for insomnia, I find that it is less effective to tell the patient, "You will have a good sleep," than to say, "All your senses will be temporarily abolished; you will feel nothing, hear nothing, and see nothing." In nervous patients hearing is the sense which demands nullification, and for them I find the antiphon of Wichmann quite effective: a piece of rubber tubing (3 cm. in length), not larger than the external auditory canal and closed at one end, is filled with cotton impregnated with vaselin, and the closed end is inserted into the canal. Küpper uses a small loop of silver wire with the ends twisted together in a small coil. Wax is molded over the coil to make a small ball, with which the ear is plugged. The wax adapts itself to the shape of the meatus and shuts out external noises completely.

Now, respecting the direct action of drugs, we may formulate some conclusions. In neurasthenic subjects the bromids are effective as hypnotics. In renal disease we try diet and elimination treatment. If the arterial tension is high, we use vasodilators. In the insomnia due to low blood-tension a daily hypodermic injection of strychnin or the employment of a reliable preparation of ergot is effective. We correct a faulty metabolism in dyspeptics and gouty subjects, and when auto-intoxication is suspected, we employ a mild purgative. I always fear insomnia in a subject who has had *syphilis*, for very often it is a precursor of arterial degeneration or intracranial disease. Here antisyphilitic treatment must be thorough, for the conventional hypnotics are untrustworthy and palliative only. In the *cardiopath* and in the aged, when the vascular tone is diminished, nothing proves more effective than digitalis or some other cardiac tonic. When pain is the cause of the insomnia, opium or one of its alkaloids is efficient, the usual hypnotics proving ineffective. This drug is also efficient in the insomnia of anemic subjects by increasing the cerebral blood-supply. On the contrary, opium is not effective in the insomnia of cerebral congestion. Here from the action of opium one may draw conclusions respecting the cerebral circulation. Thus, in alcoholic delirium opium is not effective, because in the latter condition there is cerebral congestion. In all such conditions of congestion, chloral, sulphonal, and veronal are more efficacious. In nephritis one must always use opium with caution.

ORGANOTHERAPY.

Marrow.—This may be given in tabloids containing powdered medullary substances in 3-grain doses three times a day. A teaspoonful of fresh marrow from the bones of the ox or calf is the dose for a child daily and about 50 to 100 grams to adults (Shaw). Other preparations are medulladen (6 to 9 grams daily) and opomedullinum (6 grams daily). Marrow has been used in many pathologic conditions of the blood, notably in pernicious anemia, chlorosis, and leukocythemia, but the clinical reports are so contradictory that no conclusions can be formulated respecting the diagnostic or therapeutic value of this preparation.

Ovarian Preparations.—Many clinical and experimental observations show that the internal secretion of the ovary determines the sexual characteristics of the woman, and that the inhibition of this secretion in consequence of removal or atrophy of the ovaries causes many characteristic symptoms. Such symptoms especially manifest at the *menopause* are as follows: nervous symptoms of a neurasthenic character, obesity, headaches, tremors, flushings, anginal attacks, and mental troubles. The clinical results respecting the use of ovarian preparations vary: some report cure of the obesity, others relief of the flushings, and still others relief of the neurasthenic symptoms. More uniformity of opinion exists with reference to the relief of vasomotor disturbances. Many skin disorders associated with the menopause have been favorably influenced by ovarian preparations. In all the foregoing instances the latter assist in diagnosis and treatment. In functional *ovarian insufficiency* the use of such preparations may establish the diagnosis. Insufficiency may be suspected if menstrual disorders exist associated with vasomotor and nervous phenomena. A reliable powder prepared from the ovary is usually used. There are two preparations, *ovaraden* and *ovariin*, on the market. The dose of the former is 15 to 30 grains, thrice daily, in tablets; and of the latter, 3 to 6 grains, in tablets, thrice daily. There are other trustworthy preparations manufactured. Very often treatment must be continued for several weeks before results are observed.

Secretin.—The duodenal mucosa in the norm elaborates a substance known as prosecretin, which is converted into secretin by the hydrochloric acid in the duodenal contents; secretin is then absorbed in the blood, and, reaching the pancreas directly, stimulates the secretion of that gland. Some varieties of *diabetes* are supposed to be caused by a diminished internal secretion of the pancreas, and it has occurred to Abram[218] and others that if secretin can influence the external, it may also cause an increased internal, secretion, and thus prove advantageous in the pancreatic forms of diabetes. In fact, it is assumed that if secretin is beneficial, it signifies that the duodenal mucosa may fail to yield secretin. In the treatment of several cases of diabetes by means of an acid extract of duodenal mucous membrane there was a complete disappearance of the glycosuria.

Suprarenal Preparations.—Since the physiologic activity of the suprarenal glands was demonstrated in 1894, there have been extracted from them *epinephrin*, *suprarenin*, and a crystalline substance now known as *adrenalin*. The latter is now in common use, and represents more fully than the others the active properties of the glands.

Adrenalin.—This agent causes a decided rise of blood-pressure, due to its vasoconstrictor action on the blood-vessels and by its direct action on the heart. It causes retardation and strengthening of the heart-beat. The vascular constriction is most pronounced in the splanchnic and muscular vessels, and feeble or absent in the cerebral and pulmonary vessels. The renal vessels are first constricted, with diminished flow of urine, but dilate with larger doses and increased flow of urine. The augmented blood-pressure almost immediately succeeds the use of the drug, but it is of short duration. It has been found that vasoconstriction is of greater duration than the rise of blood-pressure, and this is explained by the fact that the stimulating effect on the heart is of less duration than the stimulating action on the arterial musculature. Adrenalin exceptionally has a tendency to cause cardiac inhibition, and thus lower the blood-pressure, which is prevented by a dose of atropin. Doyon found that after intravenous use of the drug the resulting contraction of the bronchial musculature produced a picture resembling *asthma*. On the other hand, Bullowa and Kaplan recommend *adrenalin chlorid* hypodermatically in asthma in doses of 3 to 6 minims of the 1 : 1000 solution, and the attacks are relieved in two minutes. I have also found it, generally speaking, one of the most efficacious agents in inhibiting an asthmatic paroxysm, but I employ it in doses of from 8 to 15 minims hypodermatically. I have found it equally serviceable in many forms of dyspnea, even when morphin was without effect. When adrenalin is effective in asthma, percussion of the lungs shows that the previously resonant percussion tone of the lungs is converted into a dull or flat sound. The more effective the action, the flatter will be the percussion sound. Adrenalin, like ergot and a few other agents, has a specific action on the longitudinal fibers of the bronchial musculature, and provokes the lung reflex of contraction (Abrams). Intravenous injections of adrenalin, according to Lépine, always cause a rise of temperature. Glycosuria is also caused by the drug given by the mouth or by injection, and is independent of any increase of blood-pressure. Applied locally, it produces intense ischemia, caused by the direct action of the drug on the muscular structures of the arteries. Adrenalin chlorid solution is usually employed, which is a solution of 1 of the drug in 1000 of normal saline solution, with 0.5 per cent. of chloretone. Dose by the mouth, 5 to 30 minims.

Diagnosis.—Adrenalin, as Swain observed, is a "cocain sparer," and it has been found that the addition of adrenalin to a 3½ per cent. solution of cocain is sufficient to anesthetize the nasal and laryngeal mucosa against a 15 or 20 per cent. solution of cocain used alone. The same is also true when cocain is used hypodermatically.

In either event adrenalin reduces the toxicity of cocain, not in consequence of any neutralizing effect, but owing to the prevention of absorption by the anemized tissues, and by the additional fact that less cocain is required for anesthetic purposes. Cocain has little anesthetic effect on inflammatory tissues, but when combined with adrenalin, such effects are accentuated.

Addison's Disease.—The characteristic symptoms of this affection are: anemia, debility, irritability of the stomach, and pigmentation of the skin. The latter is the chief symptom, and directs our attention to the disease, but pigmentation with asthenia is frequent in abdominal growths (tubercle, lymphoma, and cancer), in pernicious anemia (often due to arsenic), and in melanotic cancers. The diagnosis is often made late in the disease. It has been suggested to employ the ***tuberculin test***, because the capsular lesion is usually tuberculous, and thus indirectly establish the diagnosis. It has been found, however, that the symptoms of Addison's disease may occur independently of changes in the suprarenal glands (30 per cent. of all cases, Lewin), and, furthermore, that the disease may occur without any evidence of tuberculous lesions in the body. What value can be ascribed to adrenalin in the diagnosis of this disease? Heretofore the suprarenal substance was used, and it is probable that better effects would have been achieved by the use of adrenalin. Clinical observations show, however, that (1) no results were attained; (2) some of the symptoms were relieved; (3) cures were effected. In ninety-seven cases of Addison's disease in which adrenal preparations were employed, seven were made worse, forty-three derived no real benefit, thirty-one showed decided improvement, and sixteen were permanently relieved. Pigmentation became less pronounced in the majority of improved cases. At any rate, the drug is worthy of trial in this disease as an aid in diagnosis.

Suprarenal Insufficiency.—The "*tache cérébrale*" is a red line with white borders produced by drawing the nail over the skin. It is a vasomotor phenomenon present in typhoid fever and meningitis, and is without diagnostic significance. Sergent[94] directed attention to a "white line," which is the converse of the ***tache cérébrale***. Like the latter, it is evoked by drawing the finger-nail across the abdominal skin. Within thirty to sixty seconds a white line appears, which persists from two to five minutes. Sergent found the line in Addison's disease and in a number of specific fevers, all of which were characterized by low arterial tension. In these cases he found that the administration of suprarenal extract caused the white line and the low tension to disappear. He therefore regards this line as useful in the diagnosis of suprarenal insufficiency and in affections of the capsules. Other French writers have confirmed this observation. The white line is caused by a reflex spasm of the capillaries, and can be provoked in vasodilatation and in conditions of low vascular tension. There is much reason to question the constancy of the white line as a diagnostic symptom. Thus, de Massary failed to observe the sign in six cases of Addison's disease, even though the arterial tension was very low. Grünbaum[174] finds that the oral administration of suprarenal extract to normal individuals does not cause a rise of blood-pressure, and that when a rise follows exhibition of the drug by the mouth, it indicates suprarenal inadequacy. In doubtful cases the blood-pressure is accurately determined, and then 3-grain doses of the extract are administered thrice daily for three days. The pressure is again estimated, and a distinct increase is very suggestive of Addison's disease, provided there is no valvular lesion of the heart. If there is a rise of blood-pressure of more than 10 per cent., the probability that the patient is suffering from adrenal insufficiency is practically certain. No drug should be given for three days preceding the first observation. If a patient with a low blood-pressure does not react to suprarenal gland, but does to strychnin, it is additional evidence that there is no adrenal insufficiency. Suprarenal insufficiency should be tested whenever asthenia and pigmentation are present. The latter are the chief symptoms of Addison's disease, but are likewise present in many other diseases.

Eye.—Instillation of adrenalin solutions into the eye, varying from 1:10,000 to 1:1000, produce blanching of the conjunctiva, due to contraction of the blood-vessels, beginning within a minute and lasting half an hour or longer. The eye assumes an unusual brilliancy, and for that reason certain women use this drug in the eye in preference to atropin to enhance their charms. Vasoconstriction also extends to the lacrimal apparatus. By reducing congestion of the lacrimal passages one is able to express retained contents for examination, and the introduction of probes is facilitated. In certain ocular inflammations it is often difficult to say by inspection alone whether the vascularization is superficial or deep; adrenalin solves the difficulty by causing immediate evanescence of superficial congestions. Account should only be taken of the immediate disappearance of the congestion, for investigations show that even the vessels of the iris and ciliary body may become contracted, although Landolt questions this observation, claiming that there are no changes in the vessels of the iris or retina. The instillation of a few minims of a 1 : 10,000 solution of adrenalin will bring out the violet haze of the deep vessels in *iritis*, leaving an absolutely white conjunctiva. By this means an early diagnosis of iritis is possible, and posterior synechiæ prevented by an early dilatation of the pupil. In a like manner, a differential diagnosis of conjunctival and scleral disease may be made. The granules of *trachoma* in a severely inflamed eye may be brought into view by adrenalin and areas of *episcleritis* are made prominent. The following table shows the differential points between simple conjunctivitis and the other important affections of the eye with which it is frequently confused (Appleman):

	SIMPLE CONJUNCTIVITIS.	IRITIS.	GLAUCOMA.	SCLERITIS, OR EPISCLERITIS.
Pain	As of a foreign body.	Severe, worse at night.	Agonizing in head.	May or may not be present.
Vision	Unimpaired.	Dim.	Dim or absent.	Normal.
Photophobia	Absent.	Severe.	Absent.	Absent.
Injection	Coarse, superficial.	Fine, deep pericorneal.	Present in episcleral veins.	Bluish-red, localized or diffuse.
Secretion	Mucopurulent; flaky.	Increased lacrimation.	Not marked.	Not marked.
Pupillary reaction	Normal.	Sluggish or absent.	Sluggish.	Normal.
Color of iris	Normal.	Changed.	Normal.	Normal.
Tenderness	Not marked.	Marked.	Not marked.	Marked over area involved.
Synechiæ	None.	Posterior.	None.	None.
Tension of eyeball	Normal.	Normal or increased.	High.	Normal.

Byers claims that about 5 per cent. of the cases of chronic catarrh of the lacrimal canal may be attributed to nasal conditions. Such cases may be diagnosed as follows: Saturate cotton with adrenalin solution and apply the cotton to the opening of the duct in the inferior meatus. If this maneuver produces dryness of a previously watery eye, the trouble is in the nose, and treatment must be addressed to the latter.

Blepharospasm and other symptoms dependent on conjunctivitis may be temporarily inhibited by the use of adrenalin. Insufficiency of the recti muscles is not always a shortening of one of the muscles nor a superfluous length in the other. It may consist only in a spasmodic contraction of one of the muscles, and the causative irritation may be extraocular as well as intraocular. The nasal mucosa may be the site of irritation. Ringueberg[81] reports a case in which the application of adrenalin near the opening of the frontal sinus in the nose caused all symptoms to disappear in a few hours, and after treatment of the nasal catarrh, cure was effected. Loewi[355] notes that when adrenalin solution is dropped into the eye, in the norm no dilatation of the pupil ensues. From animal experimentation he assumes that the healthy pancreas inhibits the mydriasis, for when the organ is removed in animals, pupillary dilatation follows the adrenalin instillation. The foregoing fact has been utilized for diagnostic purposes in *diabetes* with a view of determining pancreatic involvement in this disease. Thus, in ten out of eighteen diabetics, mydriasis followed the instillation of adrenalin. Among twenty-eight indifferent patients mydriasis occurred only twice (in one with an affection of the pancreas and in the other with exophthalmic goiter). Quadrio reports similar findings in 25 patients; 20 were free from pancreatic disease and showed no reaction, but in 5 others (4 had a pancreatic tumor or were advanced in diabetes), pronounced mydriasis was observed in a few minutes after the instillation of 4 drops of the suprarenal preparation in the conjunctival sac.

Nose and Throat.—Adrenalin applied locally to the nasal mucosa facilitates examination of the nose (*vide* cocain in diagnosis). Applied to the vocal cords in acute hyperemia, it restores the voice for several hours, a fact of importance in singers. A catarrhal tumefaction can be distinguished from a true infiltration. With the local application of the drug, the former disappears and the latter persists. Asthmatic paroxysms of nasal origin are inhibited by local application. If the asthmogenic point is not found, an adrenalin ointment (1:1000) may be used for anointing the nasal mucosa.

Defining New-growths.—Growths and infiltrations may be accurately defined in the mucosa by the local application of adrenalin. The blood-vessels of healthy tissue readily contract, whereas in infiltrations and growths, they are not responsive to adrenalin, hence the latter remain congested, in contrast to the surrounding anemic tissues. St. Clair Thomson has used adrenalin for clearly defining the apple-jelly points of lupus, and he contends that the latter is never entirely cured until the points in question cease to appear after the use of adrenalin.

Adrenalin in Pain.—Based on the observations of Carleton,[262] there have appeared in the literature many trustworthy reports concerning the external use of adrenalin ointment (1:1000) for the relief of pain dependent on neuralgia, neuritis, and reflex pains.

Failures were noted in neuralgias emanating from toxic conditions, such as malaria, diabetes, and plumbism. It is stated that the specific action of adrenalin in functional neuralgia is so constant that its failure to relieve indicates some reflex or toxic nerve pain. It is likewise stated that the application of the ointment will arrest transferred pains, making the pain near the causative lesion more perceptible, and in this way diagnosis is aided. The quantity of ointment (1:1000) rubbed over the painful area should not exceed 3 minims, and relief is said to be usually obtained in about three minutes. Muscular and articular pains are also favorably influenced by inunction of the ointment. Given by the mouth or hypodermatically for similar pains, adrenalin was without any action. No adequate explanation has been presented in explanation of the analgesic action of adrenalin, the amount used by inunction being too small to provoke any of the recognized physiologic effects (ischemia or variation of blood-pressure). Carleton reports relief of severe congestive supraorbital pain in a number of cases in three and one-half minutes after inunctions of one minim of adrenalin ointment over the nerve-exit, and considers the application of diagnostic value; non-relief pointing to some organic lesion. It had no effect on the pain in a case of iritis. It is indicated in functional disturbances, such as those from eye-strain. In connection with this subject one may mention the observations of Tucker,[263] who advocates the local use of ***magnesium sulphate*** for the relief of pain and inflammation. He cites numerous cases of epididymitis and orchitis where the pain was relieved in a few hours. It is known that magnesium sulphate in solution, when used hypodermatically, has decided anesthetic properties. The technic consists in the application of fifteen to twenty thicknesses of gauze immersed in a saturated solution of magnesium sulphate in water. The applications must be repeated often enough to prevent the dressing from drying.

Ear.—Catheterization of the Eustachian tube is aided by adrenalin, which overcomes spasm and catarrhal tumefaction. If tinnitus is caused by occlusion of the Eustachian tube, the result of congestion of the mucosa or catarrhal otitis, temporary relief may be obtained by suprarenal extract.

Esophagus.—In nervous spasm of the gullet, a few drops of adrenalin containing cocain injected into the esophagus may give immediate relief in esophagospasm. Administered in a like manner, the passage of sounds and the stomach-tube may be facilitated.

Urology.—Before practising cystoscopy, adrenalin combined with cocain is specially useful. It reduces the amount of cocain necessary for anesthesia and prevents bleeding. It is often difficult to decide whether ***hematuria*** is of renal or vesical origin. If adrenalin solution is injected into the bladder and hematuria is arrested, one can infer its vesical origin; otherwise, its renal origin. One injects into the bladder 150 to 200 c.c. of a 1 : 10,000 adrenalin solution and allows it to remain about five minutes. In vesical bleeding this solution permits a cystoscopic examination to be made. Similarly, urethral injections of the drug will suffice to exclude the urethral source of the hemorrhage. Retention of urine dependent on ***prostatic enlargement*** may yield in a few minutes to a deep urethral injection of 2 c.c. of adrenalin solution (1 : 1000). To facilitate the introduction of instruments into the urethra, adrenalin previously injected may be used to overcome spasm and congestion. For the same reason, instruments can be made to enter the bladder in prostatic enlargement.

If urethral injections of adrenal solutions gradually increased in strength arrest a ***urethral discharge***, the latter is probably due to superficial urethral ulcerations. *Hyperfunction* of the adrenal glands is associated with renal affections, notably chronic nephritis and adrenalin has been found in the blood (adrenalemia) and urine in nephritis, and for this reason its demonstration is regarded as diagnostic. Adrenalin is demonstrated by adding a few drops of iron chlorid solution; a bluish green color ensues, and when potassium hydrate is added, the solution assumes a rose color. A more sensitive and reliable reaction is that of Ehrmann: a few drops of the urine dropped on an enucleated eye of a frog will dilate the pupil.

Osteomalacia.—Bossi[241] refers to the remarkable effects attained from the use of suprarenal extract by injection in two cases of osteomalacia. Guided by experimental observations, he concludes that there is probably some connection between the functions of the suprarenal glands and osteomalacia. He reports that he removed the right suprarenal gland from a gravid sheep. The animal showed no special disturbances for a week, when it was noted that it could not step about with the same freedom as before, and in a few hours this interference with the animal's movements became marked. The next day the joints throughout the body showed deformity, the hip bones were evidently twisted inward and were painful on pressure.

Adrenalin applied to a bleeding ulcerated surface of an internal *hemorrhoid* will, by arresting the hemorrhage, direct attention to the cause of an obscure anemia.

Painting the skin with a suprarenal preparation makes only the injured skin anemic. Winkler has shown that if a thin layer of cotton-wool impregnated with a suprarenal preparation is placed upon the uninjured skin and kept there under light pressure for about ten minutes, the areas thus treated will remain white for about thirty minutes to four hours. The latter fact is utilized in the diagnosis of lupus vulgaris (the red nodules stand out prominently). Urticaria blotches pale and the itching stops. The redness of articular rheumatism disappears entirely, but that of syphilitic origin turns gray. In psoriasis the red scales turn white. The rose-red nodules in seborrheic eczema turn yellow, thus distinguishing the latter affection from lichen urticatus, where the entire area is paled.

Many writers have noted that a chronic suprarenal insufficiency is associated with many intractable cases of ***neurasthenia.*** The signs are: arterial hypotension, subnormal temperature, feeble pulse, and the white line (*ligne blanche abdominale*) of Sergent. Here the subcutaneous use of adrenalin is indicated for diagnostic and curative purposes. The use of the drug by the mouth is without much action.

In *shock* adrenalin subcutaneously is useless. It is best given intravenously with physiologic saline solution, and the strength of the adrenalin solution should be from 1 : 10,000 to 1 : 20,000 of the saline solution. Enough should be allowed to pass into the vein until the blood-pressure has attained a safe height. No drug is of much value subcutaneously in shock, because there is not sufficient capillary circulation.

Testicular Preparations.—It has always been recognized that the testicles are associated with normal mental and physical development. In 1879 Brown-Séquard promulgated his theory that glands without excretory ducts contributed substances to the blood which were necessary to perfect metabolism. When the testes are congenitally absent, atrophied, or extirpated, there is a tendency to the development of a type known as feminism. The effects of early castration are noted in eunuchs: they are above the average in height, very fat, the skin is pale and wrinkles prematurely, the child-like voice is unaltered, and there is usually an atrophy of the thyroid gland. Testicular preparations possess little therapeutic value, hence they are of no importance in diagnosis. The good results reported have been psychic, and due perhaps in part to the presence in the orchitic extracts of phosphorus and lecithin. Testicular insufficiency is no doubt associated with *diminished virility*, and creates a morbid symptomatic picture, often incorrectly interpreted as neurasthenia. In this regard I pay no attention to the condition known as sexual neurasthenia. The sexual function profoundly influences our lives, and if diminished, it conduces to discontent, melancholy, and irritability. Virility is dependent on testicular activity, and the absence of an internal secretion annihilates all virile impulses. Passion is a minor factor in such impulses. I believe it is possible to exclude, if for diagnostic purposes only, diminished testicular activity in our lack of well-being. The testicular secretion contains an unknown ingredient, reabsorption of which creates the characteristics which are regarded as distinctive of virility. I have repeatedly demonstrated that after abdominal massage one may increase the excretion of indican in the urine. Resorption of the testicular secretion may be similarly influenced as follows: the scrotum rests on the palm of one hand; with the fingers of the other hand the testes and epididymes are frictionally massaged so that they are felt to roll repeatedly under the fingers. No pleasurable sensation is associated with the method and the patient executes the maneuver twice daily. At first the massage may be slightly painful, but with repetition of the act it is overcome. Like all methods, this one fails in a number of instances, but such failures indicate that the patient's condition is not attributable to testicular insufficiency. In a number of instances the results were phenomenally good. One may often note after the massage a decided reduction of blood-pressure. Testicular massage, by augmenting the seminal secretion, increases sexual desire and prolongs the sexual act.

Another and more convenient method of testicular massage is to grasp the scrotum in such a way that the testes are forced above the closed fist and then massaged with the palmar surface of the other hand (Fig. 29).

Thymus Substance.—The thymus gland is closely associated with the thyroid gland. Although the thymus becomes atrophied at puberty, it persists, or even hypertrophies, when the thyroid has become functionally inactive. It is also known that the thymus is enlarged in exophthalmic goiter and in acromegaly. Thymus substance may be tried in all instances where *thyroid substances* are indicated, especially when one wishes to avoid the risks of *thyroidism*. Thymus has often succeeded when the thyroid substance has failed. It is known that in marasmus of children the thymus gland atrophies and that rickets is often identified with the functions of this gland. In both diseases thymus feeding should be tried.

Preparations.—Desiccated thymus gland, dose, 3 to 10 grains; *liquid extract of thymus gland*, dose ½ to 2 drams.

Thyroid Preparations.—The thyroid gland causes morbid manifestations arising from a deficient or an excessive amount of secretion. There are many theories concerning the physiology of the thyroid and parathyroidal tissues, but that which serves

PLATE III.

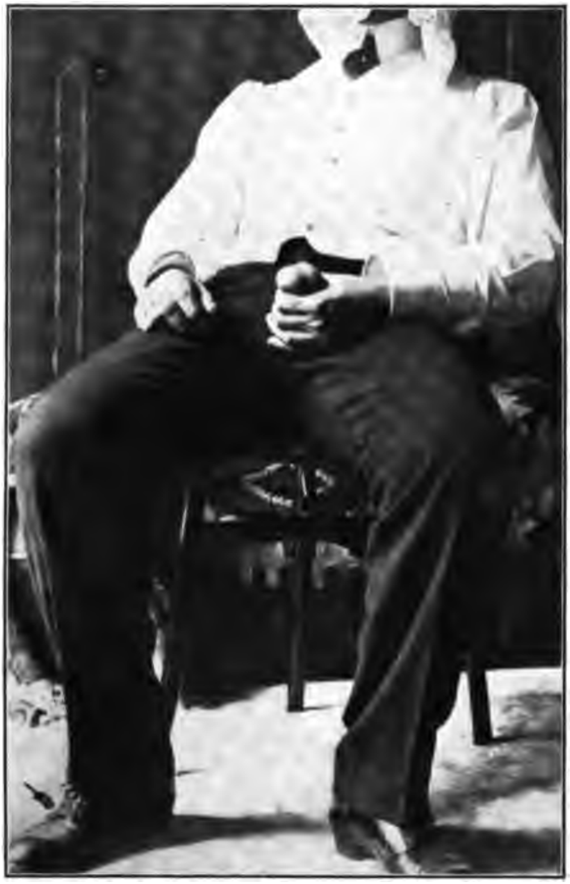


Fig. 29.—Method of executing testicular massage. The scrotum is so grasped with the left hand that the testicles are forced beyond the fingers, where they can be subjected to rotary massage by the palm of the right hand of the patient.

our present purpose refers the symptoms after removal of the tissues to an absence of an internal secretion elaborated by the thyroid gland and the parathyroid which acts as a reserve to the former. This theory also explains the origin of exophthalmic goiter by assuming that the internal secretion is excessive in amount or qualitatively changed. The most important principle isolated from thyroid glands is *iodothyrin*, which is characterized by its high content of iodin (14.3 per cent.). The latter occurs in the gland combined with albumin and globulin. The iodin content is increased by the administration of potassium iodid and decreased by an exclusive meat diet. It has been found that after thyroidectomy, a milk diet prolongs and a meat diet hastens death. In all goiters, except exophthalmic goiter, the iodin content is very much reduced. Thus in colloid goiter, there is only 0.04 to 0.09 per cent. In the new-born iodin is found in the parathyroids, but not in the thyroid gland. Gauthier demonstrated that besides iodin, the normal thyroid of man and domestic animals contains arsenic. It is claimed that thyroidism in the normal individual is prevented by the presence of arsenic, and it has been found, in fact, that in thyroid treatment the development of thyroidism may be prevented or alleviated by the simultaneous use of Fowler's solution (3 minims three times a day).

Indications.—Thyroid preparations are administered in athyrea, *i. e.*, when there is reason to suspect a hyposecretion of the gland. There are many preparations employed, but there is no reason to believe that any of them are superior to the convenient dried gland substances: *glandulæ thyroideæ siccæ*, 4 grains; *thyroid tablets*, 2 grains; and *iodothyrin*, 2 to 10 grains, thrice daily. One must begin with small doses and increase them gradually. Children receive doses in proportion to their age. Symptoms of thyroidism call for a suspension of the preparation.

Diagnosis.—An important fact to remember is the relation which the thyroid secretion bears to morbid phenomena in the female sex. The thyroid becomes actively congested and enlarges with menstruation, and during pregnancy it is usually hypertrophied. Lange found the thyroid hypertrophied in 81.2 per cent. of one hundred and thirty-three *pregnant women* whom he examined. When iodothyrin was given in small doses to a pregnant woman, the thyroid hypertrophy diminished to its normal size within a fortnight, and when treatment was arrested the gland enlarged again almost immediately. It is interesting to note that of the twenty-two cases which demonstrated no hypertrophy of the gland, sixteen had the *pregnancy kidney*, *i. e.*, tube-casts and albuminuria, which in six instances ended in eclampsia which showed a tendency to recur in successive pregnancies. On the other hand, clinical observations seem to show that normal thyroid hypertrophy in pregnancy indicates thyroid adequacy, and appears to be a protection against eclampsia. It has also been shown that eclampsia is favorably influenced by administration of the thyroid extract. Diseases of the thyroid gland are more frequent in women than in men. Thus, in two hundred cases of exophthalmic goiter analyzed by Eshner there were one hundred and sixty-one females. In the myxedema of adults women are more frequently attacked than men, and in a ratio of 6 to 1. Sporadic goiter is practically confined to women. In chlorosis enlargement of the thyroid gland has frequently been observed. It is evident, then, that in the presence of unusual morbid phenomena, especially in the female sex, one must always examine the thyroid gland. Any *swelling of the gland* is indicated either by a bulging or a fullness of the neck corresponding to the situation of the gland. Now, such enlargement may be associated with symptoms dependent either on a diminished or an excessive thyroid secretion. In the former instance one may note an altered mentality and physiognomy suggesting myxedema, or in the latter instance symptoms suggestive of undeveloped exophthalmic goiter. One must also search for aberrant and accessory thyroids. Small masses of thyroid tissue may be found around the arch of the aorta, in the mediastinum, and in the pleura. The lingual thyroid at the root of the tongue may be enlarged. The lingual goiter has been removed when the true thyroid has been absent, and myxedema has followed. One must remember that all hypertrophies associated with the thyroid gland rise during deglutition, and that this classic symptom is only imperfectly expressed or absent when the gland is fixed to the environment by adhesions. Some thyroids are permanently fixed behind the sternum (retrosternal strumas), and others only attain the latter situation by external pressure or deep inspiration (aberrant goiters, or *goiter plongeant*). To detect the former the head must hang low with the cervical muscles relaxed and during deglutition they are seen or palpated. Thyroid treatment has been phenomenally successful in the following affections: cretinism, myxedema, simple goiter, certain forms of obesity, and miscellaneous affections.

Cretinism.—Two forms, sporadic and endemic, are recognized. The latter form is encountered in certain localities, notably in Switzerland and in certain parts of Italy and France. In both forms the symptoms are associated with absence or loss of function of the thyroid gland, and may be congenital or they may not appear until some time before puberty. In the congenital form the condition is not usually recognized until the infant is about seven months old. The infant seems to be mentally defective; the tongue is large and protrudes from the mouth and the skin is dry and the hair thin. Later the face looks swollen and pale, with a waxy tint, the eyelids are puffy, the nose is depressed and flat, and dentition is delayed. There is abdominal swelling, the fontanels are not closed, and the child cannot support itself owing to muscular weakness. The mental condition approaches idiocy and imbecility. Now, there may be transient disturbances of the thyroid gland in infants. The latter suddenly lose their vivacity and present an undeveloped, cretinoid appearance. One of the earliest signs in infants is the large and protuberant tongue (macroglossia). Some children show no psychic defect and the only signs are physical. The earlier thyroid treatment is commenced, the better are the results. One must not rely wholly on thyroid treatment in improving the mental state, but should have recourse to special educational methods.

Myxedema (*Gull's Disease*).—In the adult form of this disease, occurring most frequently in women, the body increases in bulk, and the skin becomes rough, dry, and swollen. The inelastic tumefaction of the skin and subcutaneous tissues do not pit on pressure. The features become coarse and the mouth is enlarged. The mind becomes dull and there may be mental symptoms. The physical movements are sluggish. The temperature may be low. The thyroid gland is either diminished in size or completely atrophied. Death usually occurs from tuberculosis, although the disease is usually progressive and extends over a period of many years. Cases of acute and temporary myxedema have been noted in young persons associated with thyroid enlargement.

Operative Myxedema (*Cachexia Strumipriva*).—Extirpation of the thyroid may be followed by myxedema, but less often after partial than complete removal of the gland. Reverdin refers to myxedema "*fruste*," in which all the symptoms of the disease are present, but in a slight degree, and there are forms of partial myxedema in which only one symptom predominates. It is well to remember that, in athyrea, patients tolerate warm better than cold weather; in fact, warmth seems to improve their condition. Thyroid treatment can be followed as long as there are no symptoms of thyroidism. Should the latter occur, medication is temporarily suspended.

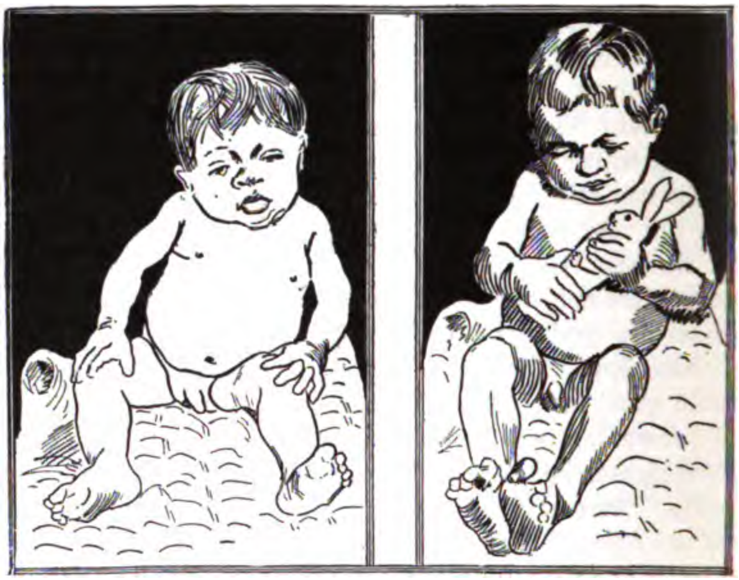


Fig. 30.—Myxedema before and after treatment with thyroid extract (after Etienne, Thiry, Spillmann and Haushalter).

Simple Goiter.—When dyspnea is caused by an enlarged thyroid, the relief of the symptom following thyroid treatment is diagnostic. When anemia is present, better results are obtained from the use of thyroid extract with iron than from the latter alone. There seems no reason to give thyroid treatment in simple goiter unless morbid phenomena accompany such enlargement. Investigations show that thyroid treatment may produce an irritation-hypertrophy followed by atrophy of the thyroid gland. One must not forget that excessive doses of thyroid in myxedema have produced symptoms of exophthalmic goiter, and that young children grow rapidly and develop spinal deformities.

Obesity.—It is difficult to differentiate clinically dietetic obesity from the forms dependent on athyrea. In the former thyroid treatment is harmful; and in the latter, beneficial; hence the varied reports concerning the action of such treatment. We have reason to suspect obesity due to thyroid inadequacy when there have been no dietetic excesses, when the development of fat is a constitutional anomaly, when several members of a family are afflicted, when young children are affected, when women suddenly develop obesity at the time of the menopause, and where there are associated symptoms leading us to suspect athyrea. In such instances as the foregoing the judicious use of thyroid extract can do no harm, provided the treatment is supervised, the loss of weight is not too rapid, and nutrition is maintained by an adequate supply of food.

Thyroid extract causes the disappearance in a few weeks or months of ***hernial protrusions*** due to accumulation of myxedematous or fatty material (Parker).

Many cases of simple goiter occurring in adolescents and young adults are probably a hypertrophy in response to a demand of an augmented secretion of the gland. Here the thyroid extract supplies the deficiency and puts the gland at rest. Exophthalmic goiter must first be excluded, for the extract would only intensify the symptoms. The thyroid treatment may be continued as long as there is no pulse-acceleration exceeding twenty beats a minute. If the patient resides in a goitrous region, then only boiled drinking-water should be used, for it is well known that endemic goiter is associated with some unknown ingredient in the water. Women with thyroid insufficiency have little or no milk, and this is said to be remedied by the administration of thyroid extract. The same insufficiency is associated with profuse hemorrhages and a tendency to abort. Hertaghe[356] also attributes some forms of enuresis (in children and adults) and adenoids to thyroid insufficiency. An enlarged tongue (macroglossia) may also be a minor evidence of insufficiency.

Miscellaneous Diseases.—Favorable reports have been recorded from thyroid treatment in many chronic *skin affections*, notably psoriasis, and in rheumatoid arthritis, arteriosclerosis, and neurasthenia. In a general way, thyroid treatment is indicated when the perspiration is nearly absent, the skin is dry and scaly, in apathetic patients who show increasing weight, and when the pulse is slow; it is contraindicated when the pulse is hurried and when there are cerebral excitement, flushings, sweatings, and a continuous loss of weight.

Acute articular rheumatism is frequently observed in association with tumefaction of the thyroid body. Thus, in one hundred and fifty-six cases of acute rheumatism observed by Vincent,[348] tumefaction was noted eighty-six times. The latter commonly disappears with the rheumatism, but it may persist in association with a typic picture of exophthalmic goiter. The salicylates are especially efficacious in the latter affection of rheumatic genesis, whereas they are without effect when the goiter is dependent on other causes.

Lasinski[349] refers to a *neuralgia* or neurosis of the celiac plexus, observed chiefly in women of the middle and poorer classes (nine-tenths of the cases), characterized by pains extending from the upper abdominal region to the back. The pains suggest a gastric affection, but occur independent of the ingestion of food and between the repasts. Pressure to the left of the median line of the abdomen from the ensiform cartilage to the navel reveals pulsation of the abdominal aorta and severe pain. In such cases the salicylates are specific and curative in several days. There are some who contend that chronic articular rheumatism is associated with insufficiency of the thyroid gland, hence, in such instances, the thyroids may be employed for diagnostic and therapeutic purposes.

In *chronic rheumatism* many cases have shown improvement and cures from thyroid treatment, and it is worth a trial in this stubborn affection.

Thyroid Migraine.—Lévi and de Rothschild report a number of cases of migraine in which the acquired or inherited tendency was successfully combated by thyroid treatment. The patients presented signs of mild chronic insufficiency of the thyroid gland, viz., chilliness, friability of the nails, fall of the teeth and hair, constipation, and pains in the joints, with scanty or painful menses. In five of the cases the migraines were suspended during pregnancy, and in two others they first appeared during a pregnancy. In one of these cases the migraine vanished during a second pregnancy, but reappeared at its close. The functional increase in the work of the thyroid gland during a pregnancy affords a kind of autotherapy of the pre-existing thyroid insufficiency. The subsidence of the thyroid gland to its previous condition of insufficient functioning after the termination of the pregnancy brings on the migraine anew. In five of the female patients a connection between the migraine and the menses was apparent. The chief argument as to the thyroid nature of the migraine is afforded by the efficacy of thyroid treatment. The periodic headache may be unilateral or bilateral, or alternating on each side; it may be in the brow, in the back of the neck, or in the face, and may last only for a few hours or as long as three days. Besides this thyroid migraine there is a form of continuous cephalalgia, accompanied by vertigo, which also yields to thyroid treatment.

Hyperthyrea.—The symptoms of *exophthalmic goiter* are supposed to be caused by a hypersecretion of the thyroid gland, and this view is supported by the fact that the symptoms of this disease may be produced after ingesting large quantities of thyroid. Against this view one cites in evidence the fact that girls at puberty with delayed or scanty menstruation may present symptoms of exophthalmic goiter which disappear when menstruation is established or when thyroid treatment has been employed. In the latter instance a chemical perversion of the secretion is assumed to exist. According to the prevailing theory, the thyroid secretion is regarded as an antitoxin which neutralizes certain toxins formed in the body, and that an excess of thyroid secretion over the quantity of toxin produced creates symptoms of exophthalmic goiter; hence, if sufficient toxin be given to neutralize the excess of secretion, the symptoms disappear.

Emerson has employed small doses of thyroid extract to arrive more certainly at a diagnosis of *Basedow's disease*, based on the principle that by feeding a possible Basedow's-disease patient with such doses an outspoken condition of exophthalmic goiter may result. Iodothyrin or iodin will act in the same way, and intolerance to iodin may be a sign of exophthalmic goiter. Emerson, of Johns Hopkins, informs me that in the thyroid test for Basedow's disease ten 5-grain doses only of a reliable thyroid preparation should be given.

Antithyroidin (Moebius).—Thyroid serum is the blood-serum of sheep from which the thyroid glands have been extirpated six weeks before the first bleeding. It is mixed with 0.5 per cent. of carbolic acid for purposes of preservation, and is sold in phials containing 10 c.c. It is, according to many reports, practically a specific in exophthalmic goiter (Graves's disease). No untoward symptoms have thus far arisen from its use. The serum is usually administered in doses of 15 to 30 minims night and morning. In mild cases the dose need not exceed 10 to 15 minims, and in some severe cases 90 to 100 drops per day were necessary to secure the desired effects. After improvement takes place the serum may be discontinued for several days and the dose reduced. It may be given during pregnancy without injurious effects. All the symptoms seem benefited in a large number of patients, and when it fails to reduce the thyroid swelling and the rapidity of the pulse, it at least has a marked sedative action and improves the psychic condition. Recent cases are more easily influenced than old cases. Improvement occurs more rapidly if the serum is given combined with a moderate rest-cure. Improvement is usually noted within one week. If no results are attained after four weeks' treatment, there is usually no hope for the ultimate success of the remedy. In cases of Graves's disease with the typic symptomatic trinity,—exophthalmos, tachycardia, and thyroid swelling,—diagnosis is, of course, easy; but in atypic cases, the partially developed forms, when nervousness, tremor, and tachycardia are alone present, it is often difficult to differentiate the latter symptoms from similar signs occurring in hysteria. In instances like the latter the serum may subserve a purpose in diagnosis. These cases belong to the so-called "formes frustes" (Charcot type) and all the cardinal symptoms may be absent. Any symptoms (tremor, palpitation, tachycardia, emotionalism, depression) present are invariably worse in the morning, with improvement at a definite hour in the afternoon. In doubtful cases the potassium iodid test may be employed; a few doses will accentuate the symptoms, and even a single painting of the skin over the thyroid gland with iodin may yield the same results.

Rodagen is a preparation made from the dried milk of thyroidectomized goats mixed with 50 per cent. of milk-sugar to improve the keeping qualities. Some improve with 5 to 30 grams daily, whereas others require 50 grams daily. No unpleasant symptoms result from rodagen, but it is evidently less rapid than the serum in action and must be given over a longer period of time.

Thyroidectin is also a marketed preparation with action similar to the foregoing. It is a dry preparation. Dose, 5 grains, three times a day.

Recently attention has been directed to localized patches of hard edema occurring in Graves's disease, and it is supposed that the symptom in question is an evidence that exophthalmic goiter has become converted into myxedema.

PARASITICIDES.

Hunter observed that there were three kinds of skin diseases: one kind cured by mercury, another by sulphur, and a third kind which the devil himself could not cure. To exclude, for purposes of diagnosis, a parasitic factor in any intractable cutaneous affection, some parasiticide should be tried. All antiseptics applied in oily solution are parasiticides, *i. e.*, they will destroy bacterial and vegetable organisms. Most of them act by destroying the organisms and removing them mechanically by the desquamation which they produce. The ordinary sulphur ointment diluted once or twice, with a dram of liquid storax to the ounce, is useful. Any irritation following the use of the ointment calls for greater dilution. Unguentum hydrargyri ammoniati and unguentum zinci oxidi, equal parts, well massaged into the affected parts twice daily, make an ointment which is rarely followed by irritation. It is an undoubted fact that scabies is frequently confounded with eczema, prurigo, pruritus, urticaria papulosa, and other skin affections.

The *acarus scabiei* of scabies, or the itch, digs a burrow (*cuniculus*) beneath the epidermal layer of the skin. This cuniculus consists of a minute, dark-colored line, not unlike a piece of dark sewing-silk run beneath the surface. The dark line is the track of the acarus, and at the end of the line the acarus is found. Washing the skin makes the dark line more apparent. In recent cases and in individuals who are very cleanly the cuniculi are hardly visible, but may be made more apparent by ink, which fills the burrows by capillarity. The burrows are most easily found on the palm of the hand, interdigital spaces, thenar eminence, and palmar surface of the wrist. Sabouraud[239] cures itch in an hour and a half by the following method: The patient is first rubbed for half an hour with black soap (green or soft soap); he then takes an alkaline bath for half an hour. After coming out of the bath the entire surface of his body is to be well rubbed with:

Oil of verbena Gum tragacanth	āā 1 part
Precipitated sulphur	100 parts
Glycerin	200 parts

To be well mixed.

A final bath is then to be taken, lasting from fifteen to twenty minutes. The clothing and body linen must be disinfected. During the fortnight succeeding this treatment four baths of starch water are given. In case there should be cutaneous irritation, local applications of ointment of zinc oxid are used. In many affections of the skin a parasitic element is dominant, even though the disease is not included among the parasitic skin affections. *Tinea versicolor* is caused by a vegetable mold. The yellowish or brownish color of the eruption may suggest to the practitioner some pigment-change in the skin, but the latter shows no desquamation. The results of treatment, however, are conclusive, and the following method cures: For three successive nights a hot bath is taken and the pigmented areas are well scrubbed with yellow soap. After the areas are dried, they are moistened with vinegar and water and then sponged with a solution of sodium hyposulphite (1 dram to the ounce). As a rule, after the third application the areas disappear.

Many *cutaneous remedies* are inefficient because they do not penetrate or because they are daubed on the affected part over scales and crusts. The latter should be removed before applying the salve. Cataplasms or warm oil are effective for this purpose. Resorcin has an excellent keratolytic action. This agent induces desquamation and contracts the vessels of the derma. It is used as an ointment (gr. x to xv to ʒv of wool-fat). Sutton, who has recently studied the ***absorption of ointments***, reaches the following conclusion: Lard, simple or benzoated, and pure goose-grease are the most quickly absorbed of all the substances tested, and that the addition of a small amount of cedar-wood oil to an ointment considerably increases the rapidity of absorption. His conclusion was based on the following method: An anilin dye mixed with divers vehicles was applied to the bare skin, and after a time the anointed patch was excised and the tissue sectioned and studied with the object of noting the penetration of the dye.

In chronic eczema which resists ordinary treatment the method of Hebra of converting a chronic into an acute dermatitis may be tried: A piece of wool dipped in liquor potassæ is vigorously scrubbed over the patch until red oozing spots appear. Then the potash is washed off with warm water and vaselin ointment applied. The process may be painful, but it is very effective in relieving the itching. Professor Kromayer finds in pruritus, notably pruritus ani, a number of vesicles under the epidermis, which when destroyed by liquor potassæ or the *x*-rays, bring relief and cure. If the skin is irritated from scratching, the potash method is not indicated.

It is surprising to note the good results following the use of an ointment coupled with massage. For cleansing the skin Bruck[267] advocates the use of benzin, which is absolutely unirritating. He also states that a single application of petroleum benzin on cotton or lint will at once arrest the tendency to redness of the nose from strong coffee or tea, emotions, or exposure to cold or heat, observed in some individuals. The benzin will also abolish the shiny aspect of the nose occurring with the hyperemia or without it. The benzin-impregnated cotton is pressed on the spot for a few seconds, without rubbing, covering merely the reddened parts and taking care not to allow the benzin to get into the eyes, nostrils, or mouth.

PROTECTIVES.

These are agents which protect injured and inflamed surfaces from external irritation. I may be pardoned for quoting from my book, "Transactions of the Antiseptic Club," published in 1895, the following: "Dr. Sartorius originated the 'quiescent' method of treatment. He believed that the essential object of treatment was to place the implicated part at rest. This was often the limitation of medical skill. All pain was an expression of neural activity and required inhibition of the nerve functions. He knew that if the sensory nerves of a part were deprived of their sensitiveness, inflammation was a remote contingency. Pain he regarded as a shock to the nervous system, which if repeated would seriously involve the integrity of the nervous apparatus; and as this system presided over nutrition, it was wise to protect it from the insults of pain." By the use of local anesthetics to wounded surfaces, we are carrying out what I am pleased to call a "peripheral rest-cure." We may have to go further, and inhibit pain by means of morphin or other sedative for hastening the healing of wounds. By means of this treatment, wounded and inflamed surfaces heal more rapidly, and in this sense such treatment is diagnostic, by excluding local irritation as a factor in preventing the restoration of a part. I have seen many indurated ulcers located on the lips and tongue which, having baffled conventional treatment, were regarded as epitheliomata. A mere protection of the ulcerated surfaces by means of **collodion** was all that was necessary for a cure. Previous to the application of the latter, which is somewhat painful, the wound may be rendered anesthetic by means of cocain. Superficial ulcerations elsewhere, especially in the genito-urinary apparatus, are amenable to the same protective treatment, which must have been employed to be appreciated. In the application of collodion as a protective to mucous surfaces the ordinary and not the flexible collodion must be used. The surface must first be dried with an application of compound tincture of benzoin; then cotton is applied, and on the latter the collodion. In pyemia, when veins are full of infected clot, the application of collodion prevents the absorption of infectious material by the vessels of the circulation. Contractile collodion applied to the membrana tympani in relaxation of the membrane is said to benefit deafness permanently, even in cases of long standing. In *enuresis*, to encourage children to retain the urine, collodion may be painted to form a cap over the end of the prepuce (Ringer). The cure of many skin-diseases is often a question of a good protective dressing, and for this purpose either of the following formulæ may be employed:

PASTE OF UNNA.

Zinc oxid	2 parts.
Glycerin	6 "
Gelatin	3 "
Water	8 "
Melt, mix, and add	
Ichthyol	2 per cent.

PICK'S GELATIN-GLYCERIN PAINT.

Gelatin	28.0
Water	90.0
Glycerin	26.0
Oxid of zinc	15.0
Calcined magnesia	3.0

Mix in order (water to be heated). Apply warm with brush and then cover with a thin layer of cotton.

Fisher has commented on the extraordinary proliferation of epithelium under the influence of "Scharlach R" mixed with olive oil (8 per cent.), and he employs it successfully in the treatment of *wounds* which have resisted the conventional treatment. It is probable that any other red-colored salve would have a similar action, insomuch as others have shown that, under the influence of red light, the protection to an inflamed surface is enhanced, the regeneration of the epidermis is hastened and the tissue is better nourished.

TONICS.

These are drugs which strengthen or tone the tissues by supplying them with some ingredient which, when absent, conduces to malnutrition. Alteratives which alter metabolism are often employed for tonic effects.

Glycerino-phosphates, Hypophosphites, and Lecithin.—Insomuch as many animal and vegetable cells contain phosphorus as lecithin, and especially as this element is abundant in the nervous system, it has been suggested that phosphorus and its salts are especially adapted as "nerve foods." Neither clinical nor experimental evidence justifies the latter conclusion. It has been shown that inorganic phosphorus compounds are excreted as phosphates, and are not converted into lecithin, hence the latter is now used to the exclusion of the others for stimulating nutrition.

Lecithin represents 10 per cent. of the white substance and 19 per cent. of the gray matter of the brain. It is present in all the tissues in process of development. From lecithin alone, the reports show good results in nutritive disturbances, especially if the latter are dependent on an enervated nervous system. Instead of using isolated lecithin, which is expensive, egg-yolk, which contains a large percentage of lecithin, is used instead. Muggia's method of employing lecithin from egg-yolk for infantile anemia and wasting is as follows: The yolk of a new-laid egg is placed in a glass of sterilized water containing about 120 to 200 gm.; to this is added one-fourth of a solution of sodium chlorid (7.5 : 1000). The fluid is then stirred vigorously with a glass rod, and afterward filtered through absorbent cotton. In the first instance 1 c.c. of the liquid thus obtained is injected, and the quantity is increased up to 10 c.c., which is the maximum dose. Treatment lasts for twenty days, and corresponds to the injection of about 100 c.c. of the preparation. The ordinary diet has been shown to contain sufficient lecithin for all practical purposes, but evidently it is not assimilated.

The employment of **phosphorus** and its salts is indicated in various affections of the bones and in fractures which fail to unite. It has been repeatedly demonstrated that the drug in question favors the deposition of lime-salts in bone. Phosphorus in large doses is recommended by Piffard to promote the rash in exanthematous diseases.

Iron.—This substance, like lecithin, is found in food in sufficient quantities to supply the needs of the organism, yet we know that it is not assimilated, judging from the therapeutic action of ferruginous preparations. The iron content of food varies. Blood, meat, yolk of eggs, and the green portions of vegetables are especially rich in iron (17 to 40 mg. per 100 gm. of dry substance). The following contain little iron: egg-white, milk, cereals (especially white flour). The following contain an intermediate amount:

wheat, pototoes, and the legumes (Sollmann). Iron improves nutrition and increases the percentage of hemoglobin in anemia, augments the reserve stock of iron in the body, and has a local astringent action. Only a limited portion of the quantity ingested is absorbed as an albuminate and is deposited in the bone-marrow, liver, and spleen, where it is converted into hemoglobin. The larger portion passes out in the stool as a sulphid and imparts a black color to the feces. Iron is usually given by the mouth after meals, and more rarely hypodermatically. *Ammonioferric citrate*, well diluted, is given in the latter way. The organic compounds of iron with albumin are more easily absorbed and less irritating to the digestive apparatus. I usually employ freshly made pills composed of sulphate of iron (2 grains), arsenous acid ($\frac{1}{30}$ grain), and extract of cascara sagrada (2 to 8 grains) one after each meal. I have never observed any irritant effects from the foregoing pills. Arsenic increases the efficacy of the iron and cascara counteracts its constipating action. In the choice of a ferruginous preparation one is often influenced by theory rather than by clinical observation. Many martial preparations have been discredited because they were administered when digestive disturbances complicated anemia. It is evident that under such circumstances they were probably not absorbed, and consequently could do no good. A few reliable iron preparations may be recalled.

Insoluble Preparations.—Ferrum reductum: Dose, 1 to 5 grains in pills, capsules, or lozenges. *Ferri carbonas saccharatus:* Dose, 5 to 15 grains.

Soluble Preparations.—These are the scale preparations of iron, which possess little astringency, are usually well tolerated by the stomach, and on account of their solubility may be given in liquid form: *Ferri citras*, 2 to 5 grains; *Ferri pyrophosphas solubilis*, 3 to 10 grains; *Ferri et strychninæ citras*, 1 to 5 grains; *Ferri et quininæ citratis solubilis*, 5 to 10 grains.

Albuminates.—Bunge's theory, that inorganic iron compounds were incapable of absorption and assimilation, has been demonstrated to be false. Many hemoglobin derivatives are absolutely without value.

The daily dose of iron, according to Quincke, should be at least 0.1 gm. (1½ grains) of metallic iron, and this makes it difficult to depend on the organic iron compounds to obtain so large a supply. The doses of most of the proprietary iron preparations, said to contain iron derived from blood, should be from twenty to fifty times as large as they are, to give the requisite amount of iron. These preparations may do good on account of the alcohol or bitters contained in them, but as iron preparations, they are largely unsuitable and superfluous. Organic iron preparations are usually expensive, while the corresponding inorganic compounds are very cheap.

Laspeyres,[307] from whom the foregoing is quoted, recommends Blaud's pills and the official peptonate of iron as the most convenient and economical way of furnishing iron to the organism.

Albuminates and peptonates of iron are especially indicated when digestive anomalies exist, and may be given in solution without injury to the teeth. *Iron* and *manganese, peptonized* (Merck), dose, 5 to 20 grains; *Iron somatose* and *ferratin*, dose, 3 to 10 grains in capsules or powder.

Diagnosis.—The etiology of *neuralgia* has been epigrammatically expressed as "the cry of a nerve for healthy blood." Now, this is not necessarily a piteous appeal for the normal blood constituents, which may be present in abundance, but rather an expression of an unsatisfactory blood state, dependent on toxemia from constipation or other causes. Hemoglobin, which contains iron, is of the greatest importance as an oxygen-carrier. An alteration in the percentage of hemoglobin is only an incomplete index of the condition of the blood, yet it serves as a simple and practical clinical method for such determination. The blood may be altered in a number of ways. The blood plasma contains 90 per cent. of water, serum-albumin, globulin, fibrinogen, fats, and carbohydrates and salts; all of which are influenced by nutrition. It is a mistake to believe that iron alone suffices to correct an altered state of the blood. Now, the diagnosis of *anemia* is usually based on an examination of the blood, which may show some changes in the size of the red blood-cells, which may also be deficient in number, or a diminution in the percentage of hemoglobin. It is evident to the practical clinician that the foregoing method of diagnosis is faulty, for it is not always a question of iron and corpuscles, but of oxygen and other blood ingredients.

Pulmonary Anemia.—The hematologist does not concede the existence of anemia in *tuberculosis*, and this despite the fact that there is every reason to believe it exists, judging from the pallor of the patients and the character of the disease. Here a condition is present not unlike that which exists in *polycythemia.* In the latter condition cyanosis substitutes the pallor noted in phthisis, notwithstanding the extraordinary increase in the number of red blood-corpuscles. Trousseau referred to this condition of anemia as tuberculous chlorosis, and observed that iron may cure the anemia, but hemoptysis and an acute rapidly fatal phthisis were likely to ensue. Alex. James[360] makes the following pertinent observation: "When we meet with a case which presents in a more or less marked degree all the ordinary appearances of chlorosis, and which yet on examination of the blood reveals the number of red corpuscles and the percentage of hemoglobin to be practically normal, we are very likely to find in it a history of past or present tuberculous disease." We have learned to discredit many statements emanating from the laboratory investigator, not so much because the observations of the latter are faulty, but because there is considerable difference between a laboratory and a bedside, and a test-tube and a patient. The writer designates as pulmonary anemia an altered blood state associated with functional lung incapacity. Hemanalysis may show reduction neither in the number of red blood-corpuscles nor in hemoglobin, yet the objective signs of anemia are invariably present, viz., fatigue on exertion, dyspnea, cardiac palpitation, anorexia, and constipation. This form of anemia is more frequent in children than in adults. Loss in weight is quite characteristic of pulmonary anemia, whereas in the essential anemias the well-nourished condition of the patient is manifest. Another sign which distinguishes pulmonary from other forms of anemia is that while the ferruginous preparations benefit pure anemics, in the pulmonary form they are practically valueless; at any rate, the benefit accruing from their use is evanescent. The real pathognomonic sign is the therapeutic test. Subject a pulmonary anemic to a single pneumatic cabinet treatment, or, in the absence of the latter, have him practise forced breathing over an interval of several minutes, and one invariably finds an immediate increase of hemoglobin percentage if the anemia is of pulmonary genesis. The quantity of iron in pulmonary anemia is probably normal, the element lacking being oxygen (anoxemia). Practically speaking, this hypothesis is probably correct, inasmuch as all my pulmonary anemics were cured by breathing exercises only. We know that it is not iron, as iron, that is absolutely necessary in blood formation, but merely the presence of an oxidizing substance which acts as a purveyor of oxygen and yields it to the tissues. Thus it is that copper replaces iron in the blood-lymph of certain cephalopods and crustacea. Our conventional hemoglobinometers are faulty. They estimate colorimetrically the hemoglobin, and insomuch as the color is dependent on oxyhemoglobin, it is evident that hemoglobin, although normal, may be registered as a deficiency, owing to the small percentage of oxygen which is chemically bound to the iron. Any one can prove the correctness of this observation by estimating the hemoglobin before and after vigorous respiratory exercises. Normal arterial blood contains 18.5 per cent. of oxygen chemically combined with hemoglobin and 0.6 per cent. dissolved in the plasma. Inhalations of oxygen or deep inspirations cause chiefly an increase of the dissolved oxygen. Pulmonary anemia[74] is an important early sign of tuberculosis, and systematic vigorous respiratory exercises are curative (*vide* Respiratory Exercises).

Symptoms of Anemia.—As previously remarked, hemanalysis is not to be regarded as the only method of diagnosing anemia, but as one of the methods. A few symptoms of anemia are the following: dyspnea, muscular weakness, chilliness, and gastric disturbances. Anemic nervous symptoms: increased irritability, neuralgias, vasomotor phenomena (blushing, pallor, trophic disturbances of the hair and nails), irritability of the nerves of special senses (increased sensitiveness to noises and light) and symptoms of brain anemia. In *brain anemia* the following symptoms are prominent: tinnitus aurium, visual disturbances, dilatation of the pupil, vertigo, vomiting, headache, insomnia, and apathy. Patients with the latter signs usually lose their symptoms temporarily when in the recumbent posture or when one asks them to hold the head down so that a greater quantity of blood may be forced to the brain. A useful diagnostic expedient is to cause them to inhale amyl nitrite, and during the physiologic action of the latter the symptoms are either ameliorated or disappear. Even when hemanalysis is negative, the presence of the foregoing signs calls for the diagnostic employment of iron.

Anemic Cardiac Murmurs.—The physician is often led into error by mistaking an anemic for an organic murmur, especially as cardiac palpitation and increased pulse-frequency are present. If the heart muscle becomes fatty, the heart sounds are feeble and the pulse small. The persistent use of a reliable iron preparation, by causing the disappearance of murmurs, determines their anemic character. One must not forget, however, that anemia may coexist with an organic murmur, hence a murmur which becomes less loud after the use of a chalybeate is no indication that it is not organic. It must completely disappear before we are justified in concluding that it is hemic.

Chlorosis.—Iron is as much a specific in this disease as is mercury in syphilis or quinin in malaria. It is a disease monopolized by young girls, and is usually recognized as once by the yellow-green tinge of the complexion; hence the name, "green sickness." In rare instances there is no suggestion of anemia, owing to a reddish tint of the cheeks (*chlorosis rubra*). In addition to the usual signs of anemia, there is an abundance of subcutaneous fat, and the puffiness of the eyelids and ankles may suggest nephritis. Suspicion of the latter may be aroused because albumin is found in the urine. The nature of the latter is indicated by its disappearance after iron treatment. One may readily recognize chlorosis without the aid of apparatus by allowing a drop of the patient's blood to fall on a piece of blotting-paper, and the comparative absence of color is characteristic. In using iron in this disease, one must not forget that improvement is slow and that the coincident use of laxatives increases the efficiency of the chalybeate. The pill of sulphate of iron, arsenic, and cascara (*vide Antea*) will be found efficient. Nutrition and respiratory exercises must not be eschewed in this and other forms of anemia. One must not forget that symptoms of *plethora* are intensified by ferruginous treatment.

Nucleins.—An important function of the leukocytes is to make certain deleterious substances innocuous which threaten the life of the organism. Thus, the toxins of bacteria exert a chemotactic action upon the leukocytes, which means that the latter are attracted to the bacterial focus, where they destroy the bacteria and remove them by taking them up into their bodies and carrying them away (phagocytosis). There is little doubt that an increase in the number of leukocytes (leukocytosis) bears some relation to the infections, and that, generally speaking, leukocytosis may be regarded as a defensive process of the organism against the virus of disease. Thus, in croupous pneumonia of a malignant type leukocytosis may be absent, and we are constrained to regard such absence as an unfavorable symptom. It is assumed that, in the latter instance, the organism is unable to raise the leukocyte count. In accordance with the latter view, artificial leukocytosis has been suggested as a therapeutic measure. There are many agents which will create a leukocytosis, notably nuclein and pilocarpin. *Nuclein*, however, is the most efficient of the leukocyte-increasing drugs. It is made from yeast or spleen and is a powder soluble in weak alkalies. Dose, daily, 30 to 45 grains; or hypodermatically, 15 minims of a 0.5 per cent. solution. The latter route is preferable, as some claim that nuclein is decomposed by the gastric juice. Improvement, if it occurs at all, is rapid.

Cryptogenetic Septicemia.—This term refers to a septicemia without any evident focus of local infection. Apparently healthy individuals are attacked with a persistent intermittent type of temperature which suggests tuberculosis or malaria. Among other symptoms noted are: great debility, enlargement of the spleen, articular pains, endocarditis, and cutaneous affections, notably hemorrhages. The diagnosis is extremely difficult, for it is impossible to recognize the source of infection. The infectious nature of this condition may be demonstrated by nuclein if rapid improvement should ensue from the use of the latter.

The *fixation-abscess* is a therapeutic procedure based on the same line of reasoning. The procedure is to inject from 15 to 30 minims of *oil of turpentine* on the outside of the thigh or on the lateral chest-wall. This heroic treatment is very painful, and if efficient, large abscesses form in six days, which must be opened aseptically. Many judicious observers have noted the arrest of infections after this procedure, but they suggest that the injections must not be delayed, but used as soon as the diagnosis is made. The good results have been attributed to the artificial leukocytosis, which reaches to 29,000. It has also been shown that mineral poisons injected into dogs collect in the pus of abscesses.

Albumoses.—The occurrence of albumose in the urine has been utilized in the diagnosis of local suppurations. Like many other tests of this kind, the findings are not conclusive, a positive reaction being more valuable than the negative. The reaction for albumose is almost as valuable from a clinical standpoint as the leukocyte count; it is far simpler in its application. One test that is deserving of more attention than has been accorded to it is Testevin's reaction, which apparently occurs under fixed conditions, and may be of value in the prognosis of diphtheria, typhoid, malaria, meningitis, and other infective conditions. It is apparently never present in healthy subjects, but varies in the infectious maladies named according to circumstances which have not been definitely determined. The reaction is obtained in the urine by adding to the latter, which has previously been deprived of its coagulable albumin, by heat, an equal quantity of ether. The mixture is then shaken, and forms an emulsion above the urine, having the consistence of collodion, provided the reaction is present. It is apparently dependent upon the presence of some proteid not thrown down by heat, probably belonging to the peptone group.

Elmer[358] refers to the following diseases which cause albumosuria: Multiple myelomata of bones; tuberculosis, especially pulmonary; croupous pneumonia in the stage of resolution; septicemia; pyemia; abscess; carcinoma, and sarcoma when undergoing rapid retrograde change; the leukemias and Hodgkin's disease after treatment with Röntgen rays. He suggests the following as the most practical of all tests for albumoses: The reagent consists of a 50 per cent. solution of sulphosalicylic acid in distilled water. This reagent precipitates on contact all proteids found in the urine, but the albumoses redissolve on warming the urine, while albumins, globulins, etc., do not, so that when any or all of the albumin group are present with albumoses filtered, the warmed urine will separate them, and the albumoses be determined by cooling the filtrate. Care must be taken to avoid prolonged boiling, for if mucins be present, they may be broken down, one of the products being an albumose. A very small quantity of albumose may be detected by dividing the urine after adding the reagent and warming one part while cooling the other, and comparing the tubes before a dark surface. He cites thirty-four cases of albuminuria in various diseases, with a comparison between the variations in the amount of albumoses in the urine and the leukocyte count as an index to the patient's condition, and concludes that, especially in destructive processes in the lungs, the albumoses in the urine are a more delicate guide than is the leukocyte count.

URIC-ACID SOLVENTS.

This question may be briefly dismissed by stating that, assuming that the usual remedies vaunted for dissolving uric-acid concretions are effective in the laboratory (*in vitro*), it does not necessarily follow that they are equally active *in vivo.* Uric acid is readily soluble in a test-tube containing lithium carbonate, but when the latter is ingested it is converted in the stomach into a salt (lithium chlorid) which is only a slight uric-acid solvent. Many preparations of lithia are given with alkalies, and the latter, together with large quantities of water, are efficient in stimulating the hepatic functions, and so altering metabolism as to prevent the accumulation of waste-products and facilitate their excretion. An increase of uric acid and urates in the urine is in itself an indication that the patient is getting rid of an excess of these substances, and uric-acid solvents are only indicated when uric acid in the urine is deficient in amount. The uric-acid question has been simplified by the recognition of an exogenous and endogenous output of uric acid. The former is derived directly from the food and the latter from the tissue proteid, hence in increased proteid catabolism, as occurs in fever, the increased uric-acid output is endogenous.

VASODILATORS.

These drugs produce paralysis of the vasoconstrictor mechanism, which is first manifested in the face by dilatation of the cutaneous blood-vessels (blushing). The redness is not confined to the face, but may extend over the entire trunk. With the flushing there is also a sense of heat, throbbing of the blood-vessels, headache, quickening of the pulse and respiration, and ringing of the ears. The veins are likewise dilated. The dilatation of the arterioles and veins of the splanchnic area leads to a decline in the general arterial pressure. In the administration of the drugs of this class one must push them sufficiently to secure their physiologic effects, and then reduce the dose or stop the drug when the patient complains of throbbing or a feeling of fullness in the head. Some patients show a remarkable idiosyncrasy to drugs of this class, reacting to insignificant doses, whereas others are resistant to very large doses. It is evident, then, that one must begin with small doses to test individual susceptibility.

Therapeutic Employment.—Relaxation of spasm and lowering of blood-pressure.

Preparations.—**Amyl nitrite,** usually employed by inhalation. Action is manifested within fifteen seconds and symptoms disappear within three minutes. Its action is more rapid and evanescent than all other vasodilators, hence it is employed when immediate effects are desirable, as in angina pectoris. In diagnosis I employ it exclusively. It can be inhaled either from a bottle or from broken *perles*. I have used it for diagnostic purposes many times a day for many years, and have never witnessed any untoward action from its use. Respecting the supposed danger associated with its employment in arteriosclerosis, one must remember that coincident with dilatation of the blood-vessels there is a fall in blood-pressure. The drug should not be exposed to the light, to prevent the development of hydrocyanic acid.

Erythrol Tetranitrate (Tetranitrol).—Corresponds to nitroglycerin in action. It is a milder drug than the latter, and whereas its effects appear only after an hour, they last about five hours. Dose, ½ to 2 grains, usually in tablets.

Nitroglycerin (Trinitrin).—This drug acts in about two or three minutes, but its effects only last from one-half to three hours. All the preparations of this drug must be fresh, for age renders them inert. Toleration for the drug is rapidly acquired. It is official as a 1 per cent. alcoholic solution: *Spiritus glycerylis nitratis*, dose, 1 to 3 minims. For hypodermatic use tablets or the spirit may be used.

Sodium Nitrite.—This corresponds in rapidity and duration of action to trinitrin. It is decomposed in the stomach and may cause irritation of that organ. Dose, 2 to 3 grains.

Spirit of Nitrous Ether.—Dose, ½ to 2 fldr.

While **potassium iodid** is not an active vasodilator, yet clinical observations show that by its prolonged use a lowering of blood-pressure may be secured, presumably in consequence of its vasodilator action.

Amyl Nitrite in Diagnosis.—*Headaches* may be of anemic or hyperemic origin. Inhalation of this drug will assuage the former and accentuate the latter. Similarly, *neuralgia* of anemic genesis will be temporarily benefited. The headache of arteriosclerosis, which is usually occipital, is relieved by the use of nitroglycerin or some other vasodilator, and this therapeutic test may be employed when the age of the patient suggests the arteriosclerotic genesis of the headache. When one desires to learn whether certain cephalic phenomena are associated with cerebral anemia or hyperemia, the inhalation of this drug is indicated. *Migraine* is often associated with vasomotor phenomena. At one time it was customary to divide hemicrania into two forms: spastic and paralytic. In the former the affected side of the face is pale and cold, the extremities cold, and the pulse small and of high tension. In the paralytic form the affected half of the face is flushed. Now, we are constrained to believe while such vasomotor phenomena are not always present, yet they may be present. Amyl nitrite inhalations will relieve the spastic but intensify the paralytic form. In *epilepsy*, when the aura is felt, amyl nitrite by inhalation may abort the paroxysm, and when the patient is seen in an attack, it will also control the latter. These facts are of no importance in diagnosis other than in this, that when the drug is uniformly successful, the attack may be attributed to a vasomotor spasm of the vessels supplying the motor areas in the brain. The cold stage of *malaria* lasts usually from ten minutes to an hour, but when it is of longer duration, amyl nitrite is useful in aborting it.

Blood-pressure.—This is made up of three factors—viz., force of the ventricle, frictional resistance of the capillaries, and arterial elasticity. It is generally conceded that the resistance offered by the blood-vessels is paramount in blood-pressure. If the vessels are dilated, the pressure falls; if contracted, it will rise. The nervous mechanism which presides over the tonus of the blood-vessels is the vasomotor apparatus, and while the latter, I concede, may be reflexly influenced by irritation from the blood-vessels themselves or from the end-organs of sensory nerves in general, we are inclined to forget that the vasomotor apparatus may operate independently of such influences. Emotions, and the state of mind in general, greatly influence the caliber of the blood-vessels through the vasomotor system of nerves. Take neurasthenics for a paradigm, and I have examined a large number of them at different periods under emotional influences, intense mental application, and when their brains were at rest, and in each instance my results varied. Emotional influences and intellectual application increased blood-pressure, while mental rest reduced it (*vide* potassium bromid in diagnosis). Blood-pressure is also influenced by physical activity, ingestion of food, menstruation, etc. In other words, blood-pressure, to me, signifies nothing unless one takes into consideration the vasomotor factor. In a previous communication[75] I have formulated the following conclusions: (1) Blood-pressure is an expression of action of two chief factors—ventricular force and vasoconstriction. (2) The inhalation of amyl nitrite dissipates the vasoconstrictor factor and brings into play the ventricular force, which is the real factor to be encouraged in a failing heart. (3) The vasoconstrictor factor may and does compensate ventricular inadequacy, for it is essential in most cardioarterial diseases for the blood-pressure to be maintained to afford better nutrition for the heart and to promote arterial elasticity as a means of establishing the circulation of the blood. (4) The recognition of the ventricular and vasomotor factors in blood-pressure serves as a clue in the correct administration of cardiotonics.

Vasomotor sufficiency is tested as follows: Take the blood-pressure of the individual first in the recumbent and then in the erect posture. Normally there is a postural variation. In the erect posture blood-pressure rises, owing to compensatory arteriole contraction, and this difference between recumbency and standing varies, according to my measurements with the Riva-Rocci instrument, between 15 and 30 mm. In vasomotor insufficiency the postural variations are reversed, and this is especially true in neurasthenia, notably the angiopathic form, and in the form described by myself as "splanchnic neurasthenia,"[76] where the blood shows an abnormal tendency to accumulate in the splanchnic area. I regard a continuously maintained high blood-pressure as the most constant factor in the etiology of arteriosclerosis, and, further, consider that the poisons absorbed from the intestinal canal are largely responsible for such high tension. The latter factor is easy of determination (*vide* sinusoidal current).

Vasomotor Method of Testing Cardiac Sufficiency.—As remarked before, blood-pressure is the resultant of two chief factors, viz., force of the cardiac ventricle and vasoconstriction. Remove the latter, and the ventricular force will come into play. Blood-pressure as taken ordinarily means nothing, for it is difficult to gage how much of it is due to the action of the vasomotor nerves and how much to the condition of the heart-muscle. The heart may be very weak, and yet show high blood-pressure, because vasoconstriction compensates a failing heart. The method is, briefly, to take the blood-pressure in the usual way; next have the patient inhale amyl nitrite from a bottle until the physiologic action (flushing) of the drug is secured, at which time again take the blood-pressure. In the norm the average increase of the pressure after the inhalation is from 6 to 10 mm. In cardiac enfeeblement there is a fall instead of a rise of pressure, and the degree of fall is proportional to the degree of myocardial insufficiency. All my investigations were made with the Riva-Rocci instrument. Clinicians have unreservedly accepted the dictum of the physiologist that the nitrites lower the blood-pressure. The latter may be true with toxic doses, but my clinical investigations show that amyl nitrite inhalations will, in the norm, cause the pressure primarily to fall, but the systolic pressure immediately rises. It has been shown experimentally that if a nitrite is introduced into the cerebral circulation and prevented from attaining the general circulation, there is no fall in the blood-pressure.

Arteriosclerotics, according to my clinical observations, may be classified as follows: (1) Those with high blood-pressure and strong cardiac tones who show, after amyl nitrite inhalations, a stabile or a slight rise of blood-pressure. Here the cardiac musculature is not yet compromised. (2) Those with high blood-pressure and enfeebled cardiac tones, who show after the inhalation a decided decrease of blood-pressure. In this, as well as the succeeding class, the reduction in blood-tension is influenced by the elimination of the tonus of the arteries, which was maintained by the vasomotor system of nerves, thus allowing the true endocardial pressure, which is enfeebled, to be brought into action. (3) Those with relatively low blood-pressure and enfeebled heart tones who demonstrate a still further reduction of pressure after the inhalation. In a prognostic sense the latter class of arteriosclerotics belong to the hopeless category, insomuch as the vasomotor system of nerves is either exhausted or unable to properly usurp the functions of a failing heart.

Test for Administering Heart Tonics.—All cardiac tonics may be divided into direct and indirect: the former acting by direct stimulation of the heart; the latter, by improving the nutrition of the organ or by relieving vessel-tension and hastening the output of blood from the heart. I select a reliable infusion of digitalis for diagnostic purposes. In the therapeutic stadium—*i. e.*, after its administration for about three days—it has a dual action, slowing the pulse and augmenting blood-pressure. The latter is the product of two forces—increased heart-work and augmentation of the vessel-tone. Now, it is evident that digitalis may do as much harm as it does good. Supposing, before giving digitalis, we noted that the blood-pressure was 218 mm., and that after the inhalation of amyl nitrite it was reduced to 190 mm.; that after the use of digitalis it was 215 mm., but the amyl nitrite inhalation reduced it to 150 mm. Now, the theory of action of the drug on the patient was practically as follows: The blood-pressure was essentially the same after as before the use of digitalis, but while amyl nitrite before the use of digitalis reduced the blood-pressure only 28 mm., after its use the pressure was reduced 65 mm. This would indicate that the digitalis was unfavorable in its action, for, after the tonus of the blood-vessels was removed by amyl nitrite, the greater reduction in blood-pressure demonstrated that the cardiac force was further reduced after than before the use of digitalis. In other words, digitalis was goading a jaded heart, and the high blood-pressure was illusory.

This action is not uncommon in the administration of digitalis, owing to its vasoconstrictor influence, and when the latter implicates the coronary blood-vessels, the nutrition of the heart must suffer. In the case just mentioned digitalis showed an unfavorable action, but when it was given in combination with diuretin, which antagonizes the vasoconstrictor components of digitalis, the action of the latter drug was more favorable, the blood-pressure falling only 15 in lieu of 65 mm. Any of the nitrites may be combined with digitalis or strychnin when the vasoconstrictor effects of the latter are undesired. Strychnin, like many other drugs, has been discredited as a heart tonic because clinical measurements of the blood-pressure show no rise. The fact is that the vasomotor mechanism which supplements the cardiac vigor increases the blood tension when the latter is enfeebled, and diminishes it when the cardiac strength is not involved. After adequate doses of strychnin hypodermatically, the vasomotor method of estimating pressure shows the cardiotonic properties of strychnin. In all instances cardiac auscultation and sphygmomanometry are necessary for estimating the action of cardiotonics. The sphygmomanometer only gages the force of the left ventricle, and to determine the sufficiency of the right ventricle, auscultation of the cardiac tones is alone adequate. The cardiac chambers, even in health, are not constant as far as their diameters are concerned; on the contrary, they contract and dilate; in other words, their capacity tends to diminish with increasing cardiac vigor, hence percussion shows an increase or diminution in the area of cardiac dullness according to whether the heart is insufficient or sufficient.

Angina Pectoris.—This is not an independent but a symptomatic paroxysmal affection. It may be associated with changes in the coronary arteries (organic), or the latter may not be implicated (functional angina pectoris). The theory that best explains its genesis is that of Allan Burns, viz., transient ischemia of the heart-muscle in consequence of disease or spasm of the coronary arteries. In my opinion the *heart-reflex theory* best explains the origin of the true and functional forms.

Heart Reflex.[77]—This reflex can only be observed with the Röntgen rays. Irritation of the skin in the precordial region by vigorous rubbing with a blunt instrument causes a contraction of the myocardium, which is more manifest in the left than in the right ventricle. The duration of contraction is not momentary and may continue as long as two minutes. The accompanying illustration (Fig. 31) shows the degree of myocardial recession (heart reflex) in a boy aged eight years. *A*, normal outline of the heart; *B*, outline after cutaneous irritation by means of an ink-eraser (rubber). Duration of reflex, two and one-half minutes.

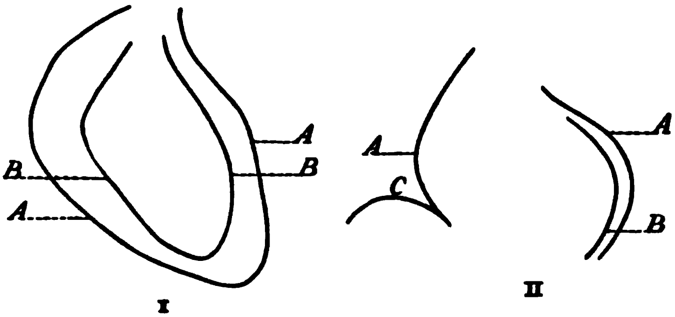


Fig. 31.—I, Heart reflex in a boy aged eight years. Duration of reflex, two and a half minutes. *A* represents the normal outline of the heart drawn on the fluoroscope, and the degree of myocardial recession is shown by line *B*. II, Heart reflex in a boy aged fourteen years. Duration of reflex, fifty-five seconds. Here myocardial recession is confined to the left ventricle; *A* representing the cardiac outline before, and *B* after, cutaneous irritation. *C* represents the upper hepatic line.

As before remarked, the heart reflex can be observed directly with the rays, but if strong percussion is employed, so that reliance is alone placed on the deep or relative cardiac dullness, the reflex in question may be determined by percussion. The superficial cardiac dullness gives erroneous results, insomuch as the maneuver which provokes the heart will also elicit the lung reflex, which would give an apparent decrease in the area of cardiac dullness. Heitz[203] observes that while in the normal subject the heart reflex is of short duration, in cardiectasis it may persist for several hours.

In the third edition of their book ("*Examen et séméiotique du coeur*") Merklen and Heitz show graphically the effects of friction of the skin in the region of the heart in a cardiac neurasthenic (Fig. 32) and in a cardiopath with hyposystole (Fig. 33). In the latter case the reduction in the hepatic dullness is shown following the friction. The continuous lines show the superficial and deep dullness of the heart before, and the interrupted lines the reduction of such areas after, friction of the skin.

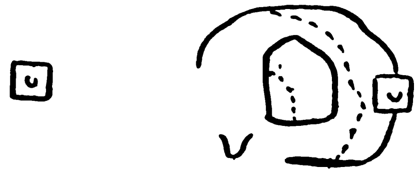


Fig. 32.—Heart reflex in a neurasthenic with functional troubles of the heart; reduction of the absolute and relative cardiac dullness (Merklen and Heitz).

The heart reflex is observed in the sagittal diameter as well as in the transverse cardiac diameter. The heart reflex may be discharged from more remote regions, viz., by irritation of the nasal mucosa by vapors (ammonia, chloroform), but the latter do not

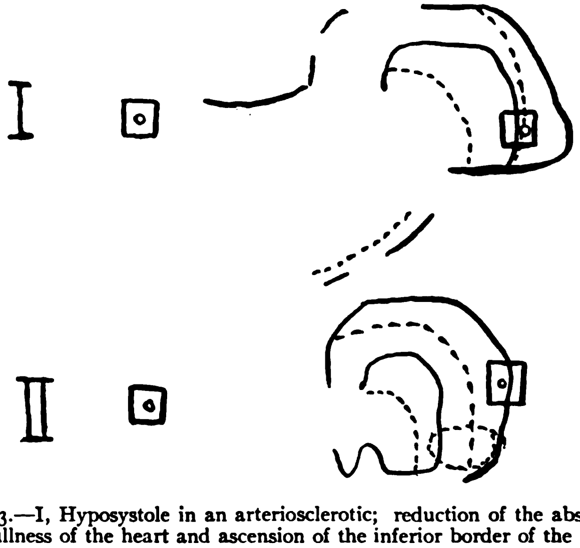


Fig. 33.—I, Hyposystole in an arteriosclerotic; reduction of the absolute and relative dullness of the heart and ascension of the inferior border of the liver after precordial massage. II, Cardiac reflex in a normal subject; reduction of the absolute and relative dullness; the black lines represent the contours of dullness prior to precordial excitation, and the interrupted lines show the degree of the heart reflex (Merklen and Heitz).

act when the mucosa has previously been cocainized, irritation of the gastric mucosa when the sponge of the gyromele is made to revolve against it, and by percussion of the muscles or by voluntary contraction of the latter. Now, the coronary arteries supply the heart with blood only during diastole, for during systole the ventricular wall is so strongly contracted that the muscular tension becomes greater than the coronary pressure, and so the coronary artery and branches are compressed and the blood is driven back into the aorta. Many causes operate in the production of an attack of angina: it may be an emotion, a disturbed stomach, muscular effort, or a gush of wind striking the chest. It is evident that if we accept the ischemic theory of the spasm we can readily understand how any of the foregoing causes operate by causing the heart reflex, and thus interfere with a proper supply of blood to the heart. According to my theory, a spasm of the coronary arteries is not essential to evoke an attack. This contention finds support in the observation of Schäfer, that the coronary vessels are unprovided with vasomotor nerves. It is evident, however, from what has already been said of blood-pressure, that the latter varies, and emotional and other influences may raise the blood-tension by contraction of the arterioles. This is, without doubt, another factor concerned in the production of the paroxysm. We have always recognized the effects of emotions on the heart, but no tangible evidence of such effects has been forthcoming. The epigram of Peter is worth repetition: "The physical heart is the counterpart of a moral heart." The conventional expression of the frightened individual, "My heart is in my mouth," finds justification by a Röntgen ray study of the organ. Tell the patient standing before the rays that you are compelled to burn his back with a hot iron, and the effect on the heart is at once manifest. It is a *psychic heart reflex*. The organ becomes at once very much reduced in size and appears as if it were retreating toward the neck. I know of no irritation, cutaneous or otherwise, that is so pronounced as is this psychic factor of fright in inducing the heart reflex.

From what has already been said, the inhalation of amyl nitrite, which is phenomenally efficient in arresting a paroxysm of angina pectoris, is in no sense diagnostic in distinguishing a true from a false angina. Very often the latter drug fails, and a few inhalations of chloroform will give prompt relief. A better method of differentiating the two forms of angina is by means of *antipyrin*. When amyl nitrite fails to relieve an attack of angina, it may be due to irritation of the nasal mucosa inducing the heart reflex, hence prior to its use cocainize the mucosa or inhale the drug through the mouth.

Cardiodynia.—Cardiac pain is a symptom in neurotic patients, and often leads them to fear that they suffer from some disease of the heart. The pain may be either sharp or dull and continuous. It is usually located in proximity to the left nipple. Exercise will intensify the pain. The pain is often associated with a feeling of anxiety or oppression in the precordial region, and is called *Herzangst* (anxiety of the heart) by the Germans. It corresponds to what we call the "gone feeling" or "sinking sensation." In the foregoing instances we are dealing with a psychic heart reflex, as I have assured myself by repeated examinations. A healthy man is not conscious that he has a heart, yet when that organ recedes from its usual position, the fact that something is missing obtrudes itself on his consciousness. The nature of cardiodynia or *Herzangst* may often be diagnosed by the instant relief obtained by inhalations of amyl nitrite. In some of these cases the symptom can be brought into existence or intensified by executing maneuvers which will evoke the heart reflex, viz., inhalation of ammonia, irritation of the skin in the precordia, fright, and muscular effort. It may be noted that while amyl nitrite produces the heart reflex, the latter is only of brief duration, and never as prolonged as after the inhalation of ammonia. As before remarked, amyl nitrite is decidedly more efficient in relieving a paroxysm of angina or anginoid pains if the nasal mucosa has been cocainized prior to the inhalation of the drug, insomuch as the latter may irritate the nasal mucosa, and thus provoking the heart reflex accentuates the pains.

Arteriosclerosis.—One must not regard arteriosclerotic vessels as rigid tubes incapable of contraction and dilatation. They are usually contracted because the pathologic process in the vessel walls acts as a more or less permanent irritant to the vasoconstrictor nerves. In consequence of such irritation, they also respond more readily to all reflex influences. Hence it is that while the vascular supply to a part is always deficient, it is still further compromised by any local or reflex influence which will produce vasoconstriction. When the latter occurs, we have accentuated symptoms of arteriosclerosis.

In cerebral arteriosclerosis spasm of the vessels may lead to transient attacks of vertigo, aphasia, monoplegia, or hemiplegia. Here the use of amyl nitrite inhalations, by controlling the spasm, may relieve the symptoms and thus demonstrate their nature. In affections of the *optic nerve* vision may be more impaired at one than at another time. This I assume to be caused by variations in caliber of the retinal vessels. In fact, I have frequently observed in amblyopia and amaurosis (absolute blindness) that vision may be temporarily ameliorated after an inhalation of amyl nitrite. One of my patients, in whom the vision was absolutely *nil*, was able to read for fully three hours after the inhalation. Less pronounced results were achieved with many patients at the Hôpital de la Salpêtrière, in Paris, who were kindly placed at my disposal by Professor Raymond. Ophthalmoscopic examination before and after the inhalation demonstrated dilatation of the retinal vessels, which persisted for some time. These cases illustrate that arteriosclerosis is associated with spasm of the retinal vessels, and I can therefore conclude that the inhalations in question may serve as an index to prognosis and treatment. We find that in *locomotor ataxia* the symptoms do not always pursue an even course. They may remain stationary or become accentuated. One knows that primarily the posterior spinal ganglia, and later the spinal cord and peripheral nerves, are involved, but why this degeneration begins in these situations is merely a matter of conjecture. One knows that there are certain affections of the spinal cord associated with intoxications. Thus, in ergotism, a posterior spinal sclerosis is encountered which resembles in distribution the degeneration peculiar to tabes. Now, ergot manifests its toxic action by vasoconstriction, and it appears to me reasonable to assume that the degeneration in tabes is secondary to an arteriosclerosis of the spinal vessels, and that when symptoms in the incipient stage of the disease, like the pains and visceral crises, occur in paroxysms, there is a temporary anemia of the involved tissues resulting from a transient spasm of the blood-vessels. At any rate, I am justified in this conclusion by the immediate relief obtained in many instances from amyl nitrite inhalations.

The distribution of the sclerosis in ataxic paraplegia has suggested to Marie that it is not a true systemic degeneration, but that the sclerosis is due to the arterial supply which involves the branches of the dorsal spinal artery. One also finds sclerosis of the dorsal and lateral columns associated with profound anemia. It may be well to record Raymond's treatment of *tabetic pains* which do not yield to mercury. A 1 per cent. solution of sodium nitrite made in distilled water, is used, and 1 c.c. is injected subcutaneously every day for ten days. It is then discontinued for ten days and a second course is given. After another interval of ten days the dose is doubled. Then ten days' rest, and the strength of the solution is increased to 3 per cent. As a rule, forty or fifty injections are used before benefit is observed, and the improvement is generally permanent.

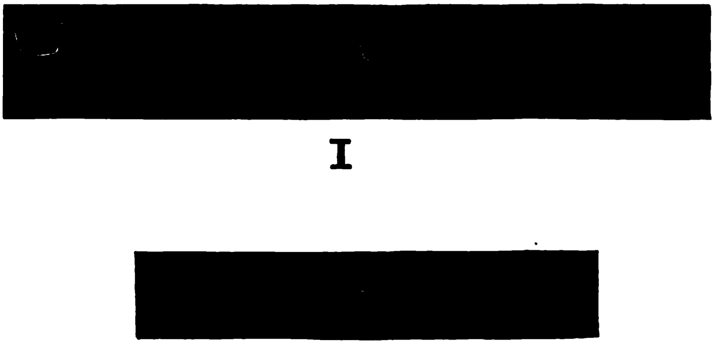
Again, one of the earliest and most constant signs of tabes is loss of the knee-jerk. In several instances in my private practice I have succeeded in temporarily restoring the knee-jerk after an inhalation of amyl nitrite. These were cases in the incipient stage. At the Hôpital de la Salpêtrière such restoration of the reflex was not obtainable after an examination of about twenty cases, but they were all advanced in the disease.

Naturally, further experimentation with amyl nitrite is necessary before one can determine its value in diagnosis, and possibly prognosis. It is claimed that in about 1 per cent. of healthy people the knee-jerk is absent. The method which I follow in obtaining this reflex is as follows: The patient stands with closed eyes while the heel of the side to be tested is raised about half an inch from the ground. The patient bears his weight on the other foot. The physician grasps the knee with one hand, so that if the reflex is not seen it can be felt (Fig. 34). When any difficulty is found in eliciting this reflex in the usual way, the inhalation of amyl nitrite is often better than reinforcement.

I have seen two undoubted cases of abdominal arteriosclerosis, one of which came to autopsy. In both cases the course of the abdominal aorta was extremely sensitive to pressure and the paroxysms of abdominal pain were relieved by amyl nitrite inhalations, hence the latter drug is perhaps of some value in the diagnosis of such cases. Intermittent lameness, or *claudication*, is caused by sclerosis of the arteries of the feet and legs. The affection is characterized by intermittent lameness, cramps, and rigidity, and in the early stages of the affection such symptoms arise only when the muscles are put in use; in other words, when more blood is demanded than can be supplied by the thickened arteries. All kinds of sensory disturbances may exist independent of the claudication. The vasomotor disturbances consist either of pallor (vasoconstriction) or of congestion (vasodilatation) of the implicated extremities. In the former amyl nitrite inhalations will relieve the sensory and motor disturbances. In sensory disturbances of the lower extremities one must always think of an angiosclerosis and employ amyl nitrite as one of the agents in diagnosis.

In crural angiosclerosis pulsation may be partially or completely absent in the dorsal arteries of the foot and in the anterior and posterior tibial arteries. In testing the latter pulsations, have the patient place the leg to be examined in the position as indicated in Fig. 35. I find this position admirably adapted for the elicitation of the pulsations. I have recently observed the following singular phenomenon: After palpating the anterior tibial artery with the leg in the position indicated, I direct the patient to forcibly extend and flex his foot (the leg remaining in the same position) a number of times in succession. If the tibial pulse is again sought, it will either be absent or very feeble. In the norm one-half minute may elapse before the pulse has attained its former volume. The blood-pressure also falls. In a patient with claudication five minutes elapsed before the tibial pulse resumed its former volume. This test may prove of value in the diagnosis of the latter affection. I assume that the tibial artery, immersed as it is in a muscular atmosphere, responds reflexly to the muscular contractions, and in arteriosclerosis the contraction of the arteries being of longer duration accounts for the phenomena associated with claudication. According to my heart reflex theory of angina pectoris (page 374), the ischemia of the heart muscle in this affection is dissociated with vasomotor action, and this is probably true in claudication, insomuch as when amyl nitrite is inhaled, obliteration of the tibial artery is effected by the muscular maneuver suggested. It is quite possible that in intermittent claudication, the latter may be located in the spinal cord.

An arteriosclerosis of the small vessels of the kidney leads ultimately to a clinical picture resembling that of the primary chronic *atrophic kidney*. The quantity of urine may be normal, however, in lieu of a polyuria which is present in the latter affection. Not infrequently a spasmodic obliteration of the sclerosed renal vessels occurs and symptoms of uremia or oliguria may be present. If the inhalation of amyl nitrite is followed by an increased flow of urine, the use of vasodilators is indicated. For a like reason *albuminuria* caused by vasoconstriction will diminish or disappear by the administration of vasodilators.


I

II

Fig. 36.—Sphygmogram of the anterior tibial artery (I) and sphygmogram of the artery (II) in claudication.

Rémond and Voivenel[196] attribute many mental maladies to cerebral ischemia provoked by vasconstriction, and they suggest the use of *trinitrin* in such cases.

Heart Murmurs.—Amyl nitrite by inhalation will intensify feeble cardiac murmurs, but ordinarily it is not serviceable in diagnosis, owing to the creation of cardiomuscular murmurs, which have no reality other than in the temporary delirious state of the organ. To bring out aneurismal pulsations while the *x*-rays are traversing the chest, it is frequently of some value.

Amyl nitrite may cause the disappearance of a systolic murmur

PLATE IV.

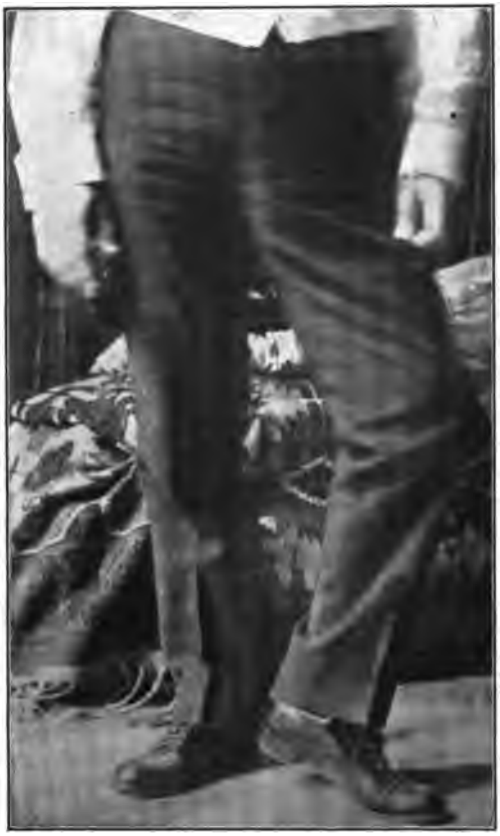


Fig. 34.—Position of the lower extremity for eliciting the knee-jerk. The heel is slightly raised from the ground with the knee flexed, while the weight of the body is borne by the other extremity. The physician grasps the knee (in the popliteal space) during the time percussion of the tendon of the patella is executed with the other hand, so that any reflex movement may be felt if it escapes detection by the eye.

PLATE V.

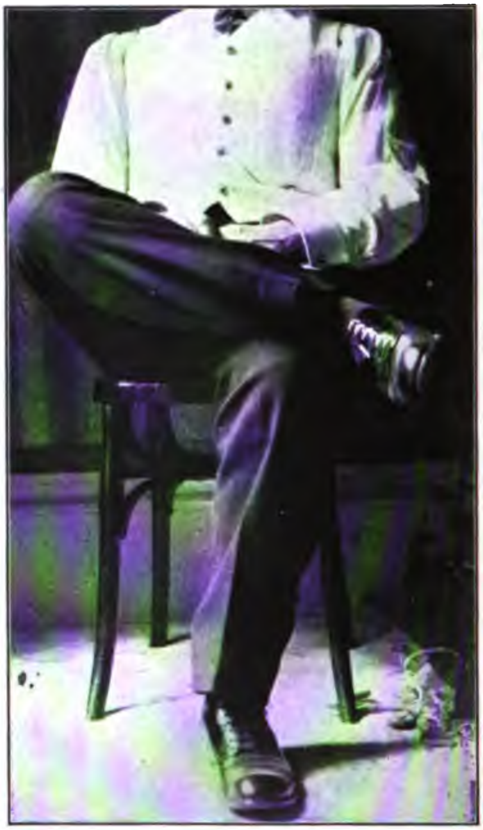


Fig. 35.—Position of the leg for palpating the anterior tibial artery, which in this position may easily be palpated through the stocking.

at the apex of the heart when it is dependent on a spasm of the mitral orifice. The condition suggests mitral stenosis (pseudo form).

Asthma.—I have employed inhalations of amyl nitrite in differentiating the râles heard in asthma from those of a concomitant bronchitis; the former disappear after inhalation, whereas the latter persist. My experience with this drug in arresting asthmatic paroxysms has been very disappointing, and it appeared to me as though the nervous and not the forms dependent on bronchial catarrh were influenced.

Spasmodic Bronchostenosis.—This affection, which I described a few years ago,[70] is naught else but asthma without paroxysms. It is a bronchospasm associated with the symptoms of bronchitis, and we have all the symptoms of the latter affection plus a spasmodic cough. The latter may persist after resolution of the bronchial catarrh. Auscultation demonstrates the presence of two kinds of râles: those peculiar to bronchitis, and dry, squeaking and groaning sounds peculiar to the bronchospasm. Inhalation of amyl nitrite will temporarily dispel râles due to spasm, while on the râles of bronchitis no effect is produced. When bronchospasm is alone present, then all râles will disappear after the inhalation. As in asthma, the patient with spasmodic bronchostenosis, when transferred to a dry climate, or even by a change of locality, may lose a cough in a single night, even after medication has persistently failed. There is only one remedy for this affection, and that is climatic change. As in asthma, every individual with spasmodic bronchostenosis is a law to himself as regards climate. When such change cannot be made, then the use of the following is indicated:

Potassium iodid	5 drams
Tincture of lobelia	10 drams
Spirits of glonoin (1 %)	16 minims
Elixir of potassium bromid	to 4 ounces

A teaspoonful three times a day after meals, and the dose may be increased if necessary.

Hemorrhages.—In *hemoptysis*, inhalation of amyl nitrite is the most efficient and expeditious expedient we possess. The foregoing statement is based on constant observations extending over a period of about five years. In a number of instances it failed to influence the hemorrhage, yet for uniformity of action it is without a rival in this condition. Unless the drug was efficacious after the first administration, subsequent inhalations did no good. Unless sufficient of the drug is inhaled to induce the physiologic action, no therapeutic results should be expected. Observations convince me[78] that the drug acts by irritation of the broncho-constrictor fibers of the vagus, which, acting on the bronchial musculature, causes the latter to express the blood from the lungs in a manner similar to that when water is squeezed from a sponge. Others have found it efficient in *post-partum hemorrhage* and in uterine hemorrhages of all kinds. Hare[80] has found that amyl nitrite administered during menstruation may stop the process.

In *urticaria* confined to the face and neck especially, and associated with edema, inhalations of amyl nitrite will often cause the immediate evanescence of the eruption.

Stevenson[388] employs nitroglycerin with marvelous success in *neuritis* after the following plan: Beginning with $\frac{1}{100}$ grain every eight hours, the interval is reduced one hour in every twenty-four until the full physiologic action of the drug is manifest or the patient is taking $\frac{1}{100}$ grain every three hours, at which interval it is continued. In acute cases the good action is manifest in the first forty-eight hours. In the chronic cases the results were not so brilliant. The drug, by dilating the arterioles of the sheath and nerve, hastens the absorption of inflammatory deposits and improves nutrition. It is reasonable to assume that the same method of treatment in obscure neuralgic pains may be tried, with the object of determining how far the pains are related to impoverished vascular nutrition of the nerves. As a temporary expedient, amyl nitrite inhalations may be tried during a paroxysm of pain.

Suggestive Action.—Amyl nitrite by inhalation produces such immediate and unusual effects that it is not without its psychic influence in the hysterical subject who is unacquainted with its action. It has often rendered me good service in controlling many of the symptoms of hysteria. I may be permitted to cite the following pertinent example of auto-suggestion. The subject, who had taken chloroform for an operation a few months before, contended while inhaling amyl nitrite that I was giving him chloroform, and in a minute or two he passed into a condition of narcosis, during which time he proved insusceptible to the infliction of pain. The latter example of auto-suggestion is an interesting one. The peculiar, penetrating, pear-like odor of amyl nitrite cannot be compared by any process of the imagination with the agreeable odor of chloroform. Again, amyl nitrite is antidotal to the physiologic action of chloroform.

Conclusions.—The use of amyl nitrite for diagnostic purposes serves as an index for treatment. The physiologic action of the drug is to relax spasms, irrespective of the location of the muscular tissue. All blood-vessels, veins as well as arteries, possess tonus which is controlled by vasoconstrictor and vasodilator nerves, and the latter have been demonstrated in every organ of the body except the brain. The vasoconstrictor are of more vital importance than the vasodilator nerves. The question of treatment does not resolve itself into a question of raising and lowering blood-pressure, for the nervous mechanism regulating the latter operates automatically. Very often a high blood-pressure is the necessary corollary of a weak heart, for such pressure promotes arterial elasticity and assists in establishing the circulation of the blood. Thus it is that such pressure falls when the heart is fortified by cardiotonics. If, after the employment of vasodilators, there is a permanent fall of blood-pressure, a rapid pulse, and no betterment in the condition of the patient, then vasodilators are harmful, for the condition present is a weak heart, and the high tension is necessary as a compensatory factor in maintaining the circulation. When arterial spasms complicate diseases, one should eliminate by treatment all factors concerned in the etiology of such spasms, for vasodilators play only a subsidiary rôle. Hypertension is more permanently influenced by venesection, purgation, diaphoretics, and diuretics in the medication line, but a correct dietary and a tranquillized nervous system are more efficient than anything else in subduing hypertension. Thus it is that bromid medication, by subduing the morbid reflexes, is very efficient in hypertension, and must not be forgotten as a temporary expedient.

MISCELLANEOUS DRUGS IN DIAGNOSIS.

Acid, Hydrobromic (Dilute).—This is employed as a substitute for potassium bromid, and is less liable to cause acne. It is a solvent for quinin and prevents cinchonism: 8 minims will dissolve 5 grains of quinin sulphate in water. It corrects the after-effects of morphin and relieves the fullness of the head often experienced after taking iron. The dose is from 1 to 4 fldr. well diluted.

Aconite.—In therapeutic doses this drug slows the action of the heart by stimulating the vagus center, and with diminished cardiac action the temperature declines in normal as well as in febrile subjects. Preparations: *Tinctura aconiti*, dose, 5 to 15 minims; *Fluidextractum aconiti*, dose, 1 minim.

Hirschfelder[82] reports a case of paroxysmal *tachycardia* in which the patient was given 2 mg. atropin to paralyze the vagus endings. The object was to determine whether or not the vagi were in tonic activity between the attacks. The atropin failed to bring on an attack, in fact, did not even increase the pulse-rate, hence he concluded that the vagi were not in tonic activity, and that something more than paralysis of the vagi was necessary to bring on a paroxysm. In this case aconite tincture was successfully used, owing to its stimulating action on the vagus center.

Wm. H. Thomson, of New York, employs aconite tincture in doses of 5 minims, three times a day, for determining whether the high tension in *nephritis* is the result of endarteritis of the renal vessels or is dependent on the presence in the blood of adrenalin substances from the adrenals. He assumes that in nephritis when the high tension is not caused by arteriosclerotic vessels, it is due to hyperactivity of the adrenals. First he estimates the urea excretion for five days in succession. Then aconite is given. In high tension independent of sclerosis of the vessels the urea excretion is very much augmented, whereas in sclerosis the augmentation is very slight. The prognosis is thus gaged, which is decidedly better when sclerosis is absent. The relief of many symptoms in nephritis by means of aconite indicates their uremic origin.

Ammonia.—Prior to making an autopsy or a vaginal examination, or to avoid infection of any kind, washing the hands with a strong solution of ammonia will direct attention to abrasions, which are irritated when brought into contact with the solution.

Argyrol.—To determine whether *epiphora* (overflow of tears) is caused by an excess of secretion or obstruction of the lacrimal duct, drop one drop of a 25 per cent. solution of argyrol into the eye. This drug is diffusible, and, if there is no obstruction of the duct, the drug passes down the latter and a brownish stain will appear on the handkerchief in a few minutes when the patient blows the nose.

Asafetida.—This, like valerian, is endowed, as has been shown empirically, with almost a specific action as a sedative in *hysteria.* No adequate explanation for its action has been elicited beyond its effects on the olfactory apparatus, and it is worthy of note that all drugs which seem effective in hysteria are "the rankest compound of villainous smell that ever offended nostril."

Boric Acid.—Gradle[281] maintains that in chronic *suppuration of the middle ear* the success or failure of conservative treatment may be predicted from the objective appearance at the primary examination. When caries or necrosis is demonstrated, cure is usually impossible without an operation, but unfortunately such lesions can only be suspected, but not demonstrated. Gradle suggests the odor test. In practice he employs the odor test in the following way: In every case in which there are no urgent symptoms necessitating prompt operation the ear is washed out until the water brings out no further discharge or débris, and boric acid powder is then blown in lightly. In successful cases the odor disappears permanently after one, or at the most two to three, treatments of this kind. At the next examination the pus wiped out with cotton is odorless.

This class of cases requires no operation. The larger number are cured by the continuance of this treatment in from one to three weeks. The disease is evidently of a superficial character. Yet he has positively known instances to react in the same favorable manner in which small areas of caries of the tympanic walls could be demonstrated. A small proportion of these patients require a longer time for cure. Exceptionally a case is met with in which it seems almost impossible to remove a trace of mucous discharge, although by some variations of the treatment (nitrate of silver or tannin in glycerin) success is usually obtained in the end. There is no reason to assume that in this class of cases an operation would prove of any benefit. The occasional relapses met with are clearly reinfections from the throat.

When irrigation followed by boric acid fails to remove the odor in the course of a few days, nothing can be gained by continuing the same treatment. Intratympanic irrigation through a very slender curved cannula will sometimes succeed, though not very often, in dislodging pent-up pus or retained epidermis scales, whereupon the odor disappears, and the now accessible source of suppuration heals. Even less frequently than from intratympanic washing he has seen the same success attained by instillations of a mixture of alcohol and ether followed by 10 per cent. carbolated glycerin. Whenever the odor can be removed by these measures, healing usually follows promptly.

In a certain number of instances the suppurating source is so inaccessible that these different therapeutic measures fail to remove the odor of decomposition. On the basis of a long experience he says positively that the continuance of the different forms of treatment so far mentioned proves absolutely useless if they fail to remove the odor promptly. The only conservative treatment which in his hands has been able to influence and cure a proportion of these patients is careful tamponing with gauze. If this is not properly done, it fails, even in suitable cases. After proper cleansing a narrow strip of good absorbent gauze should be pushed into actual contact with the source of the pus as far as it is visible. The efficiency of the drainage thus created depends on the dryness of the gauze, and hence on its frequent replacement. Drainage by gauze tampon does not remove the odor directly. Slowly the discharge lessens. It takes never less than three weeks, sometimes over six weeks, until the gauze remains dry. In some instances the odor persists until there is absolutely no secretion. In others the discharge may finally become odorless when it has been reduced to a minimum, when suppuration often ends within a few days.

This odor test would appear to be equally applicable in determining the presence of caries in the nose and in other situations.

Irrigation of the antrum with warm boracic solution and insufflation of thymol iodid into the sinuses are extremely useful in hay-fever and asthma (Schadle).

One must recall the fact that many persistent skin-lesions are the result of scratching and inoculation of pus cocci, hence an antiseptic ointment (boracic acid) combined with a local anesthetic will exclude the foregoing factors. One may cite the curious fact, observed by Brocq, that in *pruritus senilis* scratching leaves little or no mark.

Chologen.—Riedel estimated that there are two millions of people in Germany sheltering *gall-stones*, but only one-twentieth ever become conscious of their presence. Gall-stones are found at the autopsy in persons who were never aware of their presence during life. In the United States gall-stones are less frequent than in Germany (6.94 to 12 per cent.). Nearly 50 per cent. of all the cases occur in persons about forty years of age. Three-fourths of the cases occur in women, and Naunyn observes that 90 per cent. of women with gall-stones have borne children. The same observer found gall-stones in his autopsies in 25 per cent. of all women over sixty years of age. Biliary colic is the usual symptom, and the nature of the colic is often easy of diagnosis when the pain is located in the upper abdominal region and when associated with chill, fever, and slight signs of jaundice.

Ochsner[364] observes, however, that the symptoms when gall-stones are present in the gall-bladder are not biliary colic, jaundice, and passing of gall-stones with the feces, but: (1) Digestive disturbances,—a feeling of weight or burning in the vicinity of the stomach after eating; gaseous distention of abdomen. (2) A dull pain extending to the right from the epigastric region around the right side about at a level with the tenth rib, passing to a point near the spine and progressing upward under the right shoulder-blade. (3) A point of tenderness upon pressure between the ninth costal cartilage on the right side and the umbilicus. (4) A history of having had one or more attacks of appendicitis or typhoid fever. (5) In many of these cases there is a slight tinge of yellow in the skin, not sufficient to be recognized as icterus, but still sufficient to be perceptible upon close inspection, especially on the days on which the patient is not feeling very well or "bilious." (6) There is usually an increase in the area of liver dullness. (7) There may be a swelling of variable size opposite the end of the ninth rib.

There is, however, a condition known as pseudo-biliary colic, occurring in nervous women, where the diagnosis of gall-stones has been made erroneously and many other painful abdominal conditions have been confounded with gall-stones. Many attempts have been made to dissolve gall-stones, and Durande's famous mixture of three parts of ether and two parts of turpentine has been found useless. Salicylic acid, olive oil, chloroform, and glycerin have all been tried for the same purpose and abandoned. The waters of Vichy and Carlsbad have been credited with cures. More recently, chologen, which is composed of mercury, podophyllin, melissa, camphor, and caraway, has been highly recommended for gall-stones by Glaser and Aaron. Colic dependent on gall-stones yields to chologen even though the patients had taken the waters of Carlsbad, Vichy, and other spas. Chologen is made into tablets and numbered 1, 2, and 3. The dosage is limited by their action on the bowels, and it is desirable to have one or two evacuations a day. Chologen is supposed to act by causing a secretion of healthy bile which disintegrates and dissolves the calculi. Glaser's investigations show that cholelithiasis is a nervous and not an infectious disease, and treatment by chologen is based on this supposition. Chologen should be tried as a diagnostic test in all instances of abdominal pain when the nature of the latter is difficult of interpretation. If the pain is dependent on gall-stones, the results, if any, should occur early. Many writers are of the opinion that chologen should be tried before recourse is had to surgery, except in instances of empyema of the gall-bladder, perforation, general infection, and like conditions calling for immediate surgical interference.

Davis[309] lauds the following formula in catarrhal cholangitis with and without the formation of concretions:

Phenolphthalein	⅓ grain
Acid sodium oleate	1 grain
Salicylic acid, pure	1½ grains
Menthol	1 grain

Mix and make one pill.

One, two, or three pills may be taken after each meal. Davis believes that many cases ordinarily considered amenable only to surgical intervention can be satisfactorily treated by the foregoing formula, which he specifies as a cholagog, concretion solvent, and biliary disinfectant. Large draughts of hot water must be taken with the pill for the purpose of diluting the excretions and to assist in the breaking up of any concretions that may be present. *Probilin* has the following composition:

Acid salicylic	0.02 gm.
Natr. olein.	0.08 "
Natr. stear.	0.04 "
Phenolphthalein	0.01 "
Camphor menth.	0.03 "
Excip. q. s.	

It is effective not only in cholelithiasis, but in affections of the gall-bladder.

The usual dose of probilin is three or four pills twice daily, on rising and at bedtime, followed by half a pint or more of hot water, for twenty or thirty days, and then once daily for the same length of time. Up to 20 pills daily have, however, been administered in acute cases.

Carlsbad Treatment.—Among the many mineral waters justly credited with good results in the treatment of gall-stones the Carlsbad waters are pre-eminent, but to logically execute the treatment the methods at Carlsbad must be pursued, and there is no reason to doubt that equally good results may be obtained at home. The natural Carlsbad salts are preferred, dissolved in warm water and taken, as at Carlsbad, in the morning at intervals of about a quarter of an hour for each glass (6 ounces), and the dose is from two to six glassfuls, or from about 2 to 6 drams of the salt, according to its action on the bowels. A partial rest-cure is strongly advocated. The skin must be stimulated by hot baths, followed by friction, and if possible by light massage. The diet must be moderate and excesses avoided. Animal foods, according to Mayo Robson, should form the basis of the diet. Free use may be made of fresh green vegetables, salads, and ripe fruits. Fats, sugar, and farinaceous foods must be taken sparingly and dry toast must be substituted for bread. Bordeaux wine, mixed with an alkaline table-water may be allowed if necessary. If, in the commencement of a Carlsbad treatment, colicky pains develop, there is cogent reason to suspect gall-stones.

Respecting the action of olive oil in gall-stones, Brockbank suggests that oils become disintegrated in the alimentary canal and pass into the blood as an unchangeable fat, a fatty acid, and as soap, and all will dissolve cholesterin and break up a gall-stone.

The oil is given in 3 to 4 oz. doses on an empty stomach (early morning).

Chromic Acid.—It is often difficult to recognize with the unaided eye superficial denudations of the integument. This is important in the treatment of cutaneous lesions and in preventing the communication of infection to others. Thus it is that abrasions on the penis, vulva, cervix uteri, mouth, tonsils, and elsewhere often escape detection. Jullien[83] suggests the employment of an aqueous solution of chromic acid (1 in 50). This solution instantly imparts a light yellow color to all tissues, cutaneous or mucous, which have been deprived of their epithelial covering. It does not modify the appearance of the unaffected environment nor is it irritating.

Adrenalin in solution applied to an abrasion on the skin will render it anemic, leaving the other tissues unaffected. I have frequently used a solution of *silver nitrate* to detect raw surfaces on the skin, such areas being indicated by the formation of a white pellicle of silver albuminate. When such areas are found, the use of local anesthetics is effective in relieving pruritus. I have also used silver nitrate for detecting fissures of the anus, especially in children. Wallis, of London, asserts that in more than 90 per cent. of the cases of *pruritus ani* a shallow ulcer can be located, as a rule, between the internal and external sphincters. The latter lesion is often difficult to detect, and Zobel, of San Francisco, employs a weak solution of nitrate of silver, which brings out the ulcer as a dead white spot, in sharp contrast to the normal tissues. In like manner, fine cracks in the peri-anal skin, over the sacro-anal region, and in the perineum, which are often a source of a very severe type of pruritus, can be demonstrated preparatory to the application of remedial measures.

Citrate of Sodium.—The addition of this preparation (1 to 2 grains to each ounce) to cow's milk will improve the digestion of infants. This quantity of the drug affects neither the taste nor reaction of the milk. It is supposed to be of special value in those instances in which the gastric disturbance is caused by proteids. Sodium citrate diminishes the size and density of the curd caused by the casein of cow's milk and thus augments its digestibility. The use of this agent has been suggested when adults require a milk diet.

Citric Acid.—This is a specific in the prevention and cure of *scurvy*. Lemon juice is better, and may be preserved for months by boiling the juice, placing it in stone bottles while hot, and covering it with a little oil before plugging with a cork. The bottles must be placed upright.

Collargol.—This is an allotropic form of silver, which is soluble in water and the secretions of the body. It is chiefly used externally as a salve (*unguentum Credé*), and has a remarkable influence in many infectious diseases. In many instances it may be necessary in diagnosis to determine the part played by infection in a given symptomatic picture, and for this purpose collargol is indicated. The efficacy of this, like many other drugs, is accentuated by intravenous injections. By the latter route, the dose varies from ½ to ⅚ of a grain. Intravenous injections are made with a thoroughly sterilized platinum-iridium needle: the arm is constricted by an elastic bandage so that the veins become dilated without compressing the arteries; air-bubbles must be avoided; the needle is introduced horizontally into the vein and the piston is then withdrawn a little, and if this sucks up blood, one can be sure that the needle is in the vein; the medicament is then injected very slowly and the bandage removed.

Experimental evidence seems to show that there is no advantage in using antiseptics intravenously, and others contend that such injections are not wholly devoid of danger. Collargol (best used subcutaneously), if effective in septicemia, causes the temperature to fall (within six hours) with improvement of the subjective symptoms.

Ergot.—The chief therapeutic action of this drug is to contract the blood-vessels, hence in all affections, notably of the nervous system, dependent on congestion this drug may be tried. Ergot activity is best represented by the purified extract given to secure its physiologic action, viz., augmented vasomotor tension and an increase in the excretion of urine.

Fluorescein.—One may instil one drop of a 2 per cent. solution of this substance into the eye, washing off the excess with water, for detecting an abrasion, infiltration, or ulcer of the cornea, or a solution may be used composed of fluorescein 8 gr., sodium bicarbonate 12 gr. to the ounce. One drop is instilled into the eye, followed by a few drops of a solution of cocain. A green stain indicates the absence of the corneal epithelium. Loss of substance in conjunctiva is indicated by a yellow coloration. The stain persists for about three hours.*

Fluorescein is highly recommended by the leading authorities as one of the best agents for *determining death*. It is simple and reliable, and is free from risk owing to the innocuousness of the preparation. For this purpose Icard[208] injects subcutaneously a solution of 1 gm. (gr. 15) fluorescein and 1 gm. (gr. 15) carbonate of sodium in 8 gm. (gr. 120) water. As long as the circulation has not ceased the injected fluid spreads rapidly, and in this case the body acquires a greenish-yellow coloration within two or three minutes. At the same time the sclera and mucous membranes become emerald-green. If the circulation has already become slower, this phenomenon is delayed, say, fifteen to twenty minutes. When the circulation has ceased entirely, no coloration whatever will be noticeable, which is a certain indication that life is extinct, whereas a yellow coloration of the skin negatives this certainty.

It has more recently been suggested to write on filtering paper with a solution of lead acetate, "I am dead." This paper is made into a small roll and placed in the nostril of the supposed corpse. It is asserted that before any external evidence of putrefaction sulphuretted hydrogen is given off from the lungs and blackens the visible writing. The test cannot, however, be regarded as reliable.

Hydrogen sulphid blackens silver, hence a frequent test is to place a silver coin on the skin, which in case of death becomes black. Cessation of respiration is usually determined by a breath test with a mirror. Pitzman regards the following as more simple and reliable: The mouth is closed by the hand, and then the anterior nares of both sides are filled and covered with fine soapsuds. If respiration has ceased, there is absolutely no movement of the bubbles. Fluorescein is also used in transillumination of the stomach (page 210).

Fluoroform.—The employment of chloroform in *pertussis* (page 210) has been cited. Bromoform, once regarded as a specific in this affection, seems to have had its day, but many still employ it. Fluoroform is the latest applicant for favor, and Stepp[209] claims that it produces immediate amelioration and shortens the duration of the disease. A 2 to 2½ per cent. solution in water is used, and 1 to 4 drams are given every hour. It is odorless, tasteless, and regarded as non-poisonous, but is very expensive. It is important to know whether a persistent cough, especially in children, is whooping-cough, and Churchill claims that a lymphocytosis is present in over 90 per cent. of cases in the early catarrhal stage.

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* Foreign bodies embedded in the cornea will appear surrounded by a green ring.

Formaldehyd.—This agent is recommended by Strzyzowski and Rabow[200] as a suitable reagent for diagnosing the degree of diabetes. If diabetic urine be mixed with 5 per cent. formaldehyd a green fluorescence appears in many cases within twenty-four to twenty-eight hours. The occurrence of this reaction points to a grave form of diabetes, whereas its absence is a sign that the disease is of a mild form.

Hydrastis.—This is chiefly eliminated by the kidneys, and exhibits cumulative action in any interference with its excretion, as in chronic interstitial *nephritis* and in renal arteriosclerosis. Doses of 10 to 15 drops of the fluidextract, administered three or four times a day, will produce, in the presence of the foregoing affections, pronounced toxicoses, including convulsive disorders. In latent cases of the affections mentioned their true nature is revealed by the use of hydrastis (Heinrich Stern; personal communication). The development of toxic symptoms during the employment of the iodids and rhubarb often directs attention to defective kidneys. Tyson, discussing the brilliant results achieved in uremic convulsions by the use of morphin, shows that this drug is only dangerous in interstitial nephritis, where the excretion is slow, but in the parenchymatous forms, which are often the cause of the convulsions, excretion is as rapid as in health.

Hydrogen Gas.—Senn uses this gas for determining in a case of penetrating abdominal wound whether perforations of the intestines or stomach coexist. With the patient under an anesthetic and the rectal tip connected with a bag of gas, the latter is gently pressed. If intestinal perforations exist, there is general tympanites, loss of liver dullness, etc., or the gas will appear at the abdominal wound, where it may be ignited. If the distention of the abdomen follows the line of the colon, and, after passing the valve, is confined to the umbilical and hypogastric regions, it indicates that the intestine is intact. In suspected stomach injury insufflation is effected through a stomach-tube. This method is not in general use, for perforations are not always revealed, and it prolongs the operation and may force some of the intestinal contents into the abdominal cavity.

The gas for rectal insufflation of hydrogen is generated in a bottle by means of zinc and sulphuric acid, and is then collected in a large rubber-bag, to the rubber tube of which a tip is attached for insertion into the rectum. After ether is administered to relax the abdominal muscles, an assistant presses the margins of the anus against the rectal tip.

Ether vapor mixed with air may be used in lieu of hydrogen. Ether is poured into the bottle of an aspirator with the valves opened; one tube is inserted into the rectum and the other tube is attached to a bicycle pump, and by working the latter the ether vapor is forced into the bowel.

Hydrogen is also used by Senn to determine a rupture of the stomach. In complete rupture the contour of the stomach cannot be made out upon the surface and the gas passes into the peritoneal cavity, yielding the physical signs of tympanites. The method in question is objectionable, as it may increase extravasation in a rupture.

Lithium Benzoate.—In damaged corneal tissue the opaque nebulæ are often caused by deposits of calcium salts from the tears. The latter fact is evident, according to Manzet, if the nebulæ are improved by irrigations of lithium benzoate (2½ to 10 per cent.) and by instilling one drop, two or three times a day. Burning and itching, which are slight and evanescent, follow the use of the remedy.

Olive Oil.—This oil is especially indicated in relieving *spasmodic conditions*. Thus it is that when effective in constipation we are inclined to conclude that the spastic variety is present. It is given in tablespoonful doses, half an hour before meals. Very often *spastic constipation* does not respond to treatment unless high enemata of oil are employed. The oil is injected by the patient at bedtime and is retained overnight. One of the best methods of injecting the oil is that described by Dudley Roberts.[270]

The apparatus (Fig. 37) consists of a curved rectal tube of hard rubber, the end of which is olivary shaped to make it self-retaining. This tube is made curved so that it comes up in front of the pubis; to this end is attached a 10-ounce Politzer bag, the connecting soft-rubber tube being of a convenient length for the patient. The rectal tube is made with such a curve that it is readily passed from the front of the body to the anal opening; here by a slight traction movement it enters the anus in the proper direction, pointing toward the umbilicus. It has been demonstrated that this new form of tube is much less awkwardly introduced than by reaching around behind the buttocks. The Politzer bag is fitted with a stop-cock having a small hole in one side, which permits the bag to fill with air when the cock is closed. The method of taking the injection is simple: the bag is allowed to fill itself and the oil is then warmed by placing the bag in warm water. The patient lies on the back with hips somewhat elevated and introduces the rectal tube with soft-rubber tubing attached. The bag is then attached and the stop-cock turned to permit the oil to be slowly forced into the rectum. The bag being emptied, the stop-cock is turned and air dilates it so that oil may be forced from the tubing; by shutting off the stop-cock we prevent the return of any oil into the tube and obviate the danger of soiling the clothing and bedding.

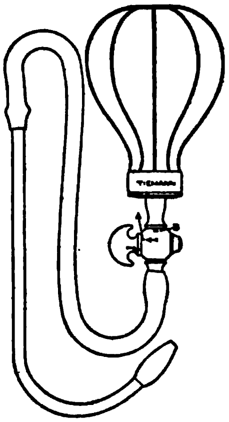

Fig. 37.—Apparatus of Dudley Roberts for injecting olive oil.

Pains in the stomach dependent on gastric spasm likewise yield to the oil. The use of oil in *pylorospasm* is diagnostic and curative. The latter spasm is often provoked by ulcers or fissures in the pyloric region or an excessive secretion of HCl. In genuine hysterical cramps of the stomach the oil is ineffective, and by means of this therapeutic test nervous pylorospasm can be differentiated from that produced by hyperacidity or even an organic cause. The symptoms of pylorospasm are gastric pains, distention of the stomach, and relief by vomiting. In less severe forms there is merely a feeling of weight in the epigastrium with eructations of gases. The area over the pylorus will be found sensitive on pressure.

Pyloric obstruction is due either to spasm of the pylorus (pylorospasm) or to organic stenosis. An ulcer near the pylorus may primarily produce spasm, and later obstruction, in consequence of a cicatrix. Hypertrophic stenosis of the pylorus is caused by a hypertrophy of the muscular and submucous tissues of the pylorus. It may occur in adults or it is congenital. In all instances one must exclude spasmodic contraction as a factor before an operation is attempted. The diagnosis of pyloric stenosis is often erroneously made, simply because the stomach fails to empty itself. The fact is that the condition more often present is muscular atony, and an organ of this kind acts as a sedimenting apparatus. Certain indigestible substances, owing to their high specific gravity, may remain for days in the stomach because they are not raised to the level of the pylorus. Sahli uses a ball of cork, 1 cm. in diameter, for determining pyloric stenosis. If the cork is found in the stool on the following day, it shows that the pylorus must be large enough to allow it to pass. On adding water to the stool, the cork will float on the water. After swallowing the cork, the patient should lie in bed for a half-day upon the left side, so that the ball may float upward into the neighborhood of the pylorus.

Oil has been used in the treatment of *gall-stones*. Some claim that it relieves the paroxysm of colic, and the majority claim that it is useless in promoting expulsion of calculi. The supposed calculi found in the stool consist usually of the oil in combination with lime, and the same concretions may form in any individual, especially those with an altered secretion of bile. In *nephrolithiasis*, the use of pure glycerin or oil, which lubricates the ureters and facilitates the passage of stones to the bladder, may aid diagnosis.

To differentiate *pleural friction sounds* from râles, Crenville suggests injecting into the pleural cavity 1 to 3 grams of sterilized olive oil. In this test, râles will remain unmodified. Itching of the skin, especially in the forms known as *senile pruritus*, is often dependent on changes in the skin itself, which becomes thin and dry, and there is an absence of the natural oil caused by changes in the glands. Here simple massage of the skin with oil often gives great relief. Many intractable affections of the skin are caused by an insufficiency of the sebaceous glands. This fact is facilely demonstrated by a simple method which I have frequently employed. It consists of pouring ether or chloroform on the suspected area. After evaporation of the latter, if the sebaceous secretion is insufficient, the skin assumes a whitish appearance and the rugæ become prominent, otherwise there is no change in the appearance of the skin. When the secretion is insufficient, thorough massage with some absorbable oleaginous preparation is advisable.

Klemperer's test for determining the *motor power of the stomach* is as follows: wash out the stomach and introduce 100 c.c. of olive oil by means of the stomach-tube. Withdraw the oil after two hours. The stomach cannot absorb oil, hence if the amount withdrawn is subtracted from the amount introduced, the difference is the amount which has passed the pylorus. In the norm, not more than from 20 to 40 c.c. should be found in the stomach after two hours.

When olive oil is ingested before meals in doses of 2½ ounces, it diminishes and delays, according to Pawlow, the secretion of gastric juice, hence this oil may be tried in *acid dyspepsia.*

According to the careful investigations of Cowie and Munson, olive oil given before a meal decreases the secretion of hydrochloric acid, hence in hyperchlorhydria it should precede the meal.

Baer suggests the injection of oil into the *joints* (which is, with proper precautions, a harmless procedure) to make passive movements painless and to prevent adhesions. In esophageal spasm a dose of olive oil is very effective.

It may be well to remember that after the removal of a *foreign body* from the cornea, a drop of oil between the lids will lessen the pain.

Pollantin.—Autumnal catarrh, or *hay-fever*, is practically an aggravated attack of coryza with constitutional symptoms. Paroxysms of asthma may alternate with the coryza or it may occur independently of the latter. It is more common in America than in Europe. It appears during the months of August and

September, attacking young and middle-aged persons, especially women. The inhabitants of cities, usually nervous individuals, are predisposed. It is a familial affection and a history of heredity may be elicited in many instances. It may be necessary to distinguish this affection from attacks of nervous coryza and bronchial asthma. Dunbar has shown that hay-fever is caused by toxalbumins contained in the pollen of different plants, notably grasses and cereals, and the severity of the attacks is in direct proportion to the quantity of pollen present in the atmosphere. When, in susceptible subjects, the pollen is applied to the conjunctivæ or nasal mucosa, attacks of hay-fever may be excited. After the injection of the toxalbumins of the pollen into animals he obtains a serum called pollantin, which is sold as a liquid or powder. The latter is snuffed into the nose night and morning during the fever season, and, according to Dunbar, success is achieved in 70 per cent. of the cases. Thus pollantin may be employed in diagnosis and treatment. If the latter is effective, the diagnosis is established. There is reason to believe that when no benefit follows the use of pollantin, the patients are not afflicted with genuine hay-fever, but suffer from asthma or some other affection. A diagnostic agent is now prepared by Schimmel & Co. consisting of pollen toxin with sodium chlorid. This is dissolved in distilled water up to 2 c.c. The latter solution (1 : 1000) is diluted 1 : 50,000 or 1 : 100,000, and dropped on the conjunctiva. In hay-fever there is a reaction (depending on dilution used), and the symptoms disappear at once by using pollantin. The directions accompanying the preparations must be carefully followed.

Potassium Tellurite.—Gosio[84] refers to the pertinent fact that it is impossible to say whether a given serum or vaccine is absolutely sterile, for even in the sterile state such media may give a sediment. He regards tellurite of potassium as an innocuous and reliable indicator of the presence of germs. In the presence of the latter the drug in question undergoes reduction, which gives rise to a color reaction. The maximum quantity of potassium tellurite present in a dose of 10 c.c. should not exceed 1 : 25,000. A higher concentration prevents the development of germs and inhibits the reaction, which is demonstrated by a blackish precipitate. No doubt the manufacturing chemist will avail himself of this preparation, and all the physician will have to do will be to note whether the serum contains specks or dark clouds, and in that event he will discard it as unfit for inoculation.

Salt.—Nothnagel's test, while not wholly reliable, may in some instances prove valuable: A crystal of sodium chlorid placed upon the serous surface of the intestine causes ascending peristalsis, and therefore indicates in operations the direction of the bowel. According to the sign of Schlange, in intestinal obstruction the intestine is dilated above the seat of obstruction and peristaltic movements are absent below that point.

Strychnin.—This drug stimulates the heart and vasomotor center in full therapeutic doses. It stimulates the functions of the spinal cord, acting principally on the motor centers. It is also stimulating to the respiratory center and the special senses of sight, hearing, and touch. It increases muscle-tonus by accentuating the reflex excitability of the spinal cord. Dose of *Strychnin* or its salts (nitrate and sulphate), $\frac{1}{60}$ to $\frac{1}{20}$ grain; *Tinctura nucis vomicæ*, 5 to 20 minims.

Incontinence of the urine (*enuresis*), when dependent on enfeeblement of the bladder sphincter, is improved by strychnin, but when dependent on overaction of the detrusor urinæ, *atropin* is indicated. Vasomotor neuroses are benefited by the drug. Nux vomica has been theoretically contraindicated in *hyperchlorhydria* on account of its supposed action in increasing the acid secretion, but Musser employs the tincture in ascending doses (30 to 50 drops for an old subject and 40 to 80 drops for a young adult, t. i. d.). If hyperchlorhydria is merely an expression of a local neurosis based on nervous instability of the individual, the drug rapidly and permanently controls the symptoms, whereas no improvement is noted in excessive acid secretion caused by a local irritative lesion, such as gastritis and ulcer. When strychnin is employed for diagnostic purposes, it should be injected deeply into the muscles. This drug acts only on the centers, and has no peripheral action, hence when the tone of certain reflexes is restored, we assume that the centers are not wholly destroyed, or that their function is diminished.

Sugar.—Keim, of Paris, believes that some form of sugar normally accelerates *parturition* by augmenting the expulsive force of the uterus. Either lactose or glucose is normally present in the urine, he argues, on the last day of pregnancy, or at any rate just before parturition. Glycosuria several weeks before pregnancy is abnormal and indicates some dyscrasia. Keim informs me that if six pieces of sugar are given to a woman who has aborted, uterine pains are provoked, provided the uterus is not completely emptied; and if there is nothing left behind, there are no pains. Very often sugar will determine whether uterine pains are real or false: if real, sugar will intensify the pain, but it is without action in false pains. He emphasizes the fact that this diagnostic-therapeutic maneuver is not invariable, and that very often it fails to stimulate uterine contractions, but if contractions occur, the conclusions as indicated may be formulated. *Lactosuria* occurring during pregnancy and lactation is not grape- but milk-sugar, and is supposed by some to be caused by a deficient outflow of the milk, which collects and undergoes resorption. Milk-sugar reduces alkaline copper solutions, but, unlike grape-sugar, it does not ferment with pure yeast and does not give the grape-sugar reaction of Rubner, viz., precipitate with lead acetate and then decompose the filtrate with ammonium until a precipitate occurs, which, upon warming, shows a rose-red color.

Tartaric Acid.—In *outlining the stomach* the patient should be in the recumbent posture and the abdomen subjected to careful inspection. The patient is then instructed to drink a solution of tartaric acid (a teaspoonful in half a glass of water), and while in the same posture he next drinks slowly a solution of bicarbonate of soda (teaspoonful in half a glass of water). The use of a bent glass tube facilitates the ingestion of the fluids in the recumbent posture. The distention of the stomach can usually be followed by this method and the position of the organ defined. The alkaline solution may be swallowed first, because in the presence of a gastric ulcer the acid may prove irritating. The acid and soda produce carbonic acid gas and the latter dilates the stomach like an air-cushion. Very often the gas escapes from the stomach and no distention occurs, and in excessive dilatation of the organ the gas is insufficient for inflation and more of the solutions are necessary. Under all circumstances the solutions must be used with circumspection, because the distended stomach may cause pain and other inconveniences. A stomach-tube connected with a Davidson syringe enables one to control the amount of air pumped into the stomach. The results, in my experience, are always better with a patient in the recumbent posture. The normal position of the greater curvature (Fig. 38) should not be lower than two fingerbreadths above the navel.

A simple method of defining the position of the lower border of the stomach is to have the patient drink one or two glassfuls of warm water and then determine by light percussion dullness in the region of the greater curvature of the stomach (Fig. 39). If the physician is in doubt concerning whether the dullness in question is due to fluid in the stomach, let the patient take more water, and the area of dullness will be found to be increased.

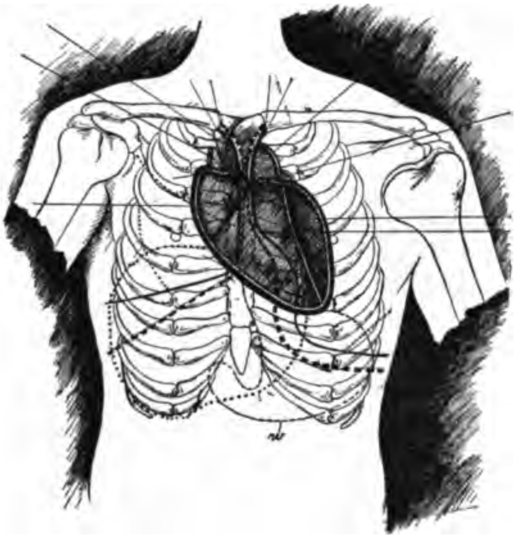

Fig. 38.—Lower border of the stomach (*w*) and the relation of the organ to the other viscera (Sahli).

One must not necessarily conclude that because the greater curvature is found lower than normal the organ is dilated; on the contrary, it is often depressed in *gastroptosis* without dilatation of the viscus. How, then, can we distinguish one condition from the other? In gastroptosis one finds associated symptoms of *intra-abdominal insufficiency*. With the water test as above described, have the patient or an assistant lift the abdominal walls upward and inward and note the effect on the area of dullness; in gastroptosis the dullness will be dislocated upward, but in simple dilatation of the organ it is uninfluenced. In dilatation, after distending the stomach with air or carbonic acid, only the greater curvature of the organ is depressed, whereas in gastroptosis percussion shows that the position of the lesser as well as the greater curvature is lower than normal.

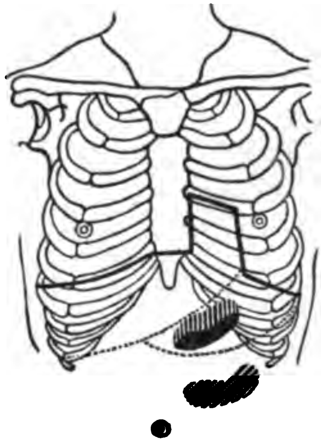

Fig. 39.—Dullness dependent on fluid in the stomach (percussion executed in the erect posture). The black area represents the dullness caused by the presence of a small quantity of fluid, and if the fluid ingested is increased, the dullness extends upward (shaded area) if the tone of the stomach is normal; otherwise it stretches the greater curvature by its weight and the dullness appears lower down (shaded area).

Dehio tests the *gastric motor power* as follows: The patient drinks ¼ of a liter of water, and then by percussion the position of the greater curvature of the stomach is determined. Then, in succession, three like quantities of water are swallowed, and the position of the greater curvature is determined after drinking each portion. When the motility is normal, there is no distention downward to any considerable degree, but when motor insufficiency is pronounced, the stomach will descend after each portion of water. In addition, a loud splashing is heard over the stomach when that region is shaken.

The physician unskilled in physical methods of examination may determine the position of the stomach after the method of Knapp.[120] The patient drinks a glass of cold water on an empty stomach, and one-half minute later the physician passes his hand, which must be warm, over the bare abdomen. A cold area corresponds to the position of the stomach.

Thiosinamin.—Mustard oil heated with alcohol and ammonia loses its irritant odor and is converted into a substance called thiosinamin, which possesses the property of softening cicatricial tissues. *Fibrolysin* is a compound of thiosinamin and sodium salicylate. It is freely soluble in water and is supplied in sealed vials. It has replaced thiosinamin because it is more rapidly absorbed and gives rise to no untoward effects. Fibrolysin is used subcutaneously, preferably by intramuscular injections into the gluteal region. It is injected at intervals of one to three days in doses of 2.3 c.c. (contents of one vial). The employment of fibrolysin is indicated in diagnosis whenever we have reason to suspect that the symptoms are caused by the presence of scarry tissue. Thus, in defective audition vertigo or tinnitus caused by induration of the tympanum or ankylosis of the auditory ossicles, good results following the drug direct attention to the character of the lesion. Similarly, pleural, pericardial, and peritoneal adhesions may be influenced. When deafness is due to adhesions in the ear, Lermoyez and Mahn employ the following:

Thiosinamini	ʒiv
Phenazoni	ʒij
Aq. destill	℥iiiss.

An ear-bath (hot) of this solution is given every morning and the membrana is massaged twice a week. In *neuritis* the pain may be caused by cicatricial tissue surrounding the nerve. In the use of this drug it is immaterial whether the injections are made at the site of the disease or at a distance.

Hebra suggested the use of thiosinamin subcutaneously in the differential diagnosis of chronic enlargement of the lymph-glands due to tuberculosis (*scrofula*) from the swelling caused by syphilis. A reaction follows the injection in from four to six hours, with subsequent cure of tuberculous glands, but syphilitic glands are uninfluenced.

Fibrolysin is advocated by Herschell,[363] of London, in the treatment of *perigastric adhesions*, which give rise more often than is supposed to a painful dyspepsia. In this condition the pains are more or less constant and accentuated after meals and when the hands are raised above the head. In order of frequency, the adhesions are located at the pylorus and posterior wall of the stomach. Herschell's cases were cured after thirty injections of the drug (no details are given of the doses employed). Leonardo claims that fibrolysin does not appear to have any direct influence on scar-tissue, but by inducing leukocytosis, which modifies the processe of filtration and diffusion about the scar.

Thiosinamin may be employed for diagnostic purposes i *syphilis* when scar-tissue is presumably responsible for lesions Wernigk[371] uses the drug in combination with mercury bichlori sodium iodid, and sodium cacodylate. He finds that by addin thiosinamin to the mercury and sodium solution and boiling, clear solution is obtained, to which is then added atoxyl or sodiu cacodylate. He prefers the intravenous employment of the com bination as follows, using 1 to 3 grains of thiosinamin at a dose:

Tie a bandage above the bend of the elbow; let the patie extend the arm rigidly and close the hand firmly. Wipe the ski over the vein with a mixture of ether and alcohol, freeze with eth chlorid, and insert needle. It is best to use a large Leur glas syringe, so that one can draw the blood into the syringe and mix with the solution, thus forming an albuminate which is less a to irritate the walls of the veins. Remove the bandage, let th patient open the hand, and inject slowly, drawing the blood bac into the syringe two or three times so as to mix it well with th contents, and so as to be sure that it has not caught in the walls the vein. Should a few small bubbles enter the circulation, n harm will result.

Toxicodendric Acid.—Stern[85] uses one or two drops of th fluidextract of the drug (prepared from freshly gathered mature leaves of the rhus) in differentiating between functional an anatomic intestinal diseases. It relieves the former and aggravate the symptoms of the latter.

Turpentine.—In *intussusception* Barnard employs the following test, which he regards as pathognomonic: Two enemas o turpentine in water are given. If the second is returned withou feces and with little force, the diagnosis is positive. If cathartic have been given by mistake in this condition, the symptoms ar aggravated. The evacuations are fecal at first, representing th contents of the bowel below the obstruction, but later they contai mucus and blood.

CHAPTER IV.*

METHODS OTHER THAN DRUG-GIVING IN THE DIAGNOSIS OF DISEASE.

Abdominal Supporters. — Acupuncture. — Blood-letting. — Catheterism. — Climatotherapy. — Cystoscopy. — Diagnostic Dietetics. — Diagnostic Electro-therapeutics.—Gymnastics (Resistance and Respiratory).— Gyromele.—Heliotherapy.—Hydrotherapy.—Hyperemia Treatment.— Hypodermoclysis. — Inflation. — Lavage. — Magnet. —Massage. — Pessaries. — Psychotherapy. — Psychrotherapy. — Puncture. — Radio-diagnosis.—Rubber Bandage.—Sounds.—Strapping. — Suspension. —Tamponade. — Transillumination. — Tuning-fork. — Vacuum-therapy. — Vibratory Massage.

ABDOMINAL SUPPORTERS.

Intra-abdominal tension refers to the pressure in the abdominal cavity. In the norm the pressure is positive; that is, it is greater than the atmospheric pressure, hence the abdominal walls are pressed outward. Intra-abdominal tension is chiefly dependent on the contraction of the abdominal walls, and this, in turn, is dependent on the strength of the muscles which make up the abdominal walls. When the muscles are strong, all things being equal, tension is increased, and decreased when they are feeble. Certain occupations increase and others diminish the strength of the abdominal muscles. Contrast the hard, flat abdomens of fishermen with the protruding bellies of shoemakers and tailors.

Tension is diminished when fat accumulates in the walls of the abdomen, in corset-wearing women, and chiefly as a result of pregnancy. General nervous enfeeblement reacts on the muscular system and thus reduces intra-abdominal tension. The amount of blood in the abdominal or splanchnic veins is merely a question of abdominal tension. When the latter is diminished, the veins contain more blood than when the tension is increased. Three factors enter into consideration in the mechanism of blood-supply to the splanchnic vessels: viz.,

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* For further information bearing on the subject-matter of this chapter, consult Chapter II (iv), on methods other than drug-giving in the etiology of disease.

(1) The contraction of the abdominal muscles; (2) the act o respiration; (3) the vasomotor action of the splanchnic vessels Reduced tension, or, as I prefer to call it, intra-abdominal insufficiency, conduces to many morbid conditions.

Diseases Caused by Diminished Tension.—Reduced tensio is an etiologic factor in many digestive disturbances, but there are two affections to which I wish to direct brief attention, viz., splanchnic neurasthenia and enteroptosis.

Splanchnic neurasthenia is caused by congestion of the abdominal veins. Such congestion interferes with a proper supply o arterial blood to the abdominal viscera, and the latter are consequently bathed in pools of stagnant blood and are practically in a state of asphyxia. The toxic products of digestion, which are normally removed by an unimpeded circulation, have a specifically poisonous effect on the sympathetic system, a fact which is evident owing to the frequent occurrence of depression, prostration, and nervous symptoms in nearly all disorders of the alimentary canal Venous congestion diminishes the vital tone of the organs and lessens their vital resistance. Splanchnic neurasthenics show relaxed abdominal walls, protrusion of the abdomen, gas accumulation in the bowels, increased abdominal sensitiveness, and enlargement of the liver

Enteroptosis, or *Glénard's disease*, is a ptosis of the abdomina viscera, or visceroptosis, in which the organs occupy an abnormall low position in the abdominal cavity. The dislocation of th viscera—stomach, intestines, and especially the transverse colon kidneys, and liver—is caused by relaxation of the peritoneal and mesenteric attachments and by a lack of support of the abdomina parietes (pregnancy and ascites). Visceral prolapse is also noted i young people associated with pronounced symptoms of neurasthenia

Diagnosis.—Intra-abdominal insufficiency is best observed i the erect posture, and the abdomen, which is normally flat, is protuberant (hanging-belly). In the horizontal posture the abdome flattens and bulges at the side. The abdominal skin is loose, and this, together with the flaccid walls, permit of palpation of th underlying organs. The latter may occasionally be seen. Feebl abdominal musculature may be concealed by a large deposit of fat but the condition of the muscles may be fairly gaged by directin the patient to raise the body while lying supine or to bear dow forcibly, when the vigor of muscular contraction can be estimated by the fingers. In pronounced cases there is a wide space between the abdominal recti. Another method of testing relaxed abdominal walls is to stand behind the patient, place the hands at each side of the abdomen, and then, drawing the abdominal wall toward you, suddenly release it; the degree of relaxation is determined by the distance which the abdominal wall falls after its release. The patient experiences a sense of comfort when the walls are raised, but when the pressure of the hands is suddenly released, a distressing sensation is experienced. Stiller refers to a sign present in a number of neurasthenics, especially those who are lean and dyspeptic, viz., a mobile tenth rib, which is not fixed to the cartilage of the other ribs, but is either wholly free (or floating) or attached only with ligament. This *costa fluctuans decima* is, according to Stiller, very common in delicate children, who in later life become neurasthenics or enteroptotics, according as nervous or dyspeptic symptoms predominate. Quincke[67] tests minor grades of pendulous abdomen with enteroptosis by noting the change of position of the umbilicus on coughing, when standing, and when lying down. With a moderate degree of pendulous abdomen there is a rise of the umbilicus of about 1 cm. or more in coughing in the erect posture, but not when reclining. Gas accumulation in the bowels is a frequent symptom.

Minor grades of reduced intra-abdominal tension exist without being detected, but the following signs which I have elaborated suffice for their detection. The physician having auscultated the heart-tones, palpated the pulse, taken the blood-pressure, and defined by percussion the borders of the heart and upper border of the liver while the patient is standing, he directs an assistant to stand behind the latter and to firmly and forcibly lift the abdomen, exerting pressure in a direction upward and inward. While the latter pressure is maintained, the physician again executes the foregoing methods of examination. Even in minor grades of diminished tension the following are noted: the heart-tones become stronger, the pulse is endowed with more character, as is evidenced by palpation, but particularly by the sphygmogram, and the blood-pressure is augmented from 5 to 30 mm. The percussional areas of the heart and liver become higher and more pronounced. The

altered clinical symptoms are caused by prolapse of the hea
(*cardioptosis*), which, observation has taught me, is almost a co
stant symptom in diminished intra-abdominal tension.* T
determination of reduced abdominal tension, as already observe
is a valuable clue to the diagnosis of enteroptosis, especially so
after the abdomen is raised, the upper border of the liver or t
heart is higher than before. I have noted that, when displaceme
in the kidney accompanies the condition, there is a tympanitic ar
on percussion over the displaced kidney in the lumbar region, a
that this tympany is supplanted by dullness on percussion duri
the time the abdomen is raised by the assistant. Becker and Len
hoff suggest the following index:

$$\frac{d.\ j - p}{c.a} \times 100\ d.h.$$

The numerator expresses in centimeters the distance between t
jugular fossa and the symphysis pubis; and the denominator, t
minimum circumference of the abdomen. An index above
suggests a palpable kidney.

If any of the foregoing signs suggest reduced tension, then so
relief should be secured by an abdominal support, and the amelio
ation thus obtained still further suggests the correctness of t
diagnosis. Some writers oppose the use of mechanical suppor
for the reason that many of them cause pain and discomfort a
fail to act as supports at all. A proper support should give i
mediate relief. Its making and primary application should n
be left absolutely to the discretion of the artisan, but the physici
having acquainted himself with the heart-tones, pulse, and bloo
pressure, and defined by percussion the borders of the heart a
liver, will be in a position to know whether the support merits
name. It is known that the relief attained by a support is not d
wholly to reposition of the organs, as is demonstrated by t
observations of Bial.[86] The latter applied transparent bandag
to cases of gastroptosis and transilluminated the stomachs befo
and after the application of the bandages. No change in the po

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* In this condition I have frequently noted a systolic murmur at the ao
which disappears during the time the abdomen is lifted by an assistant, but re
pears when the abdominal walls are permitted to drop. The author refers
murmur to narrowing of the aorta by the prolapsed heart.

tion of the stomach could be noted. In my opinion, supporters act chiefly by compression of the viscera, which in turn squeeze the blood out of the turgid abdominal veins. The latter view suggests that in reduced tension the symptoms are mainly provoked by intra-abdominal congestion.

I find that a leather belt with buckle sufficiently broad (2½ or 3 inches), and which can be adjusted by the patient with varying degrees of pressure, is one of the best, simplest, and cheapest abdominal supporters. It matters little where the location of the abdominal pressure resides as long as the latter is augmented. With such a support as described, the abdomen below the belt

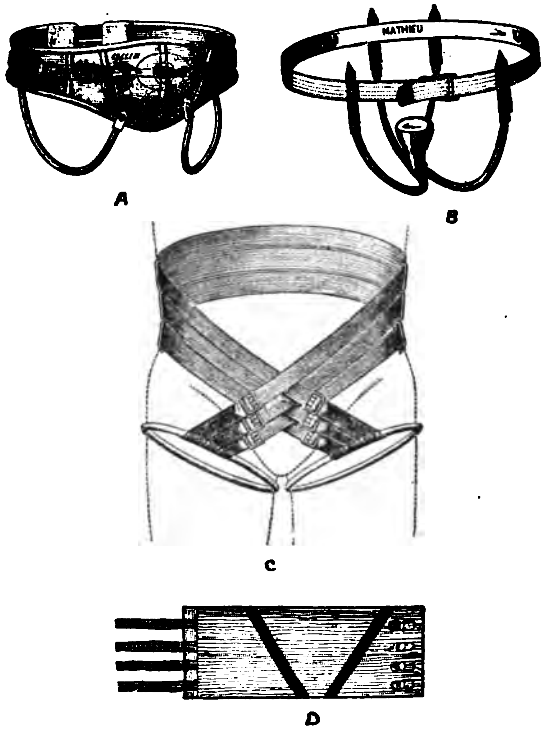

Fig. 40.—Abdominal Supporters: *B*, Hysterophore for uterine support; *C*, Bradburne's belt for displacements of the viscera (it consists of two thigh rings of rubber tubing covered with flannel, to which are attached three strips of elastic webbing; it is especially efficient in supporting the lower part of the abdomen); *D*, pelvic girdle.

bulges, but this seems in no wise to influence the relief obtained b
the patient (*vide* cardio-splanchnic phenomenon). In hypertroph
of the heart or in fatty overgrowth of the organ (*cor adiposun*
patients often complain of dragging or painful sensations in th
precordial region. Here, I am convinced, the cause is essential
due to a cardioptosis caused by the augmented weight of the hear
and relief is almost immediately secured by an abdominal suppo
which lifts the organ in question. One knows that the normal hea
in the male weighs about 12 ounces, whereas in hypertrophy
the organ the weight may be from 25 to 53 ounces.

In strapping the abdomen it is best to place the patient in th
Trendelenburg position, although the dorsal position is employe
by most clinicians (*vide* strapping).

Mucous colic, if associated with splanchnoptosis, may be ben
fited by an abdominal support, and the latter is at least worthy of
trial in such cases. One of the most positive remedies for chron
diarrhea is abdominal strapping (Rosenwater). Liebmann a
tributes many cases of *constipation* to a slight ptosis of the intesti
conducing to a kinking at some point, and comments favorably o
the use of an abdominal support in treatment.

Spivak employs a pelvic girdle for raising the abdominal wal
The pelvic girdle differs from the abdominal bandage in the follo
ing points: Instead of being concave in front, with both ends tape
ing, the girdle is made of an oblong strip of elastic material of su
ficient length to encircle the pelvis, and five or six inches wid
The girdle is applied in such a way that the lower border is in co
tact with the pubic bone, both extremities are passed horizonta
above the trochanters, and are fastened behind over the sacr
region by means of three or four bands. The elasticity of t
material, the ease with which the girdle is fitted by the patient hi
self, the freedom from chafing, and the pressure from before bac
ward and from below upward which it exerts are points in its fav
(Fig. 40). In women a long, low, and well-fitting corset gives
the abdominal support necessary.

In *abdominal venous congestion* digitalin and strophanth
alone or in combination, are invaluable. They are endowed w
the property of constricting the splanchnic vessels alone, wher
digitoxin constricts all the blood-vessels.

ACUPUNCTURE.

Lumbago (*myalgia lumbalis*) may be confounded with many reflex troubles and affections of the vertebral column. It is also very frequently confounded with affections of the sacroiliac joints. In the latter condition pressure forward and inward over the anterior superior iliac spines will augment the pains, and very often dry-cupping over the joints in question is attended by immediate relief.

The diagnostic symptoms of *Pott's disease* (tuberculous disease of the spine) are pain, stiffness and rigidity of the spine, and deformity. The spines of the affected vertebræ are painful on pressure and percussion. Pain is increased by movement and relieved by rest, and the spinal muscles are in a condition of spasm to immobilize the spine when the patient is in the erect posture. The pains are bilateral, often symmetrical, and intermittent, like the lightning pains of tabes. Such pains almost invariably improve rapidly when the patient is confined to bed. The site of the pains usually corresponds to the site of the spinal disease. Usually other evidence of tuberculosis infection can be demonstrated.

If the lumbar pains originate in the muscles alone, acupuncture, by its almost miraculous curative action, is diagnostic of lumbago. It matters little whether the muscles or their tendinous attachments are involved—the results are equally good. This method originated with Ringer. It can be executed painlessly if local anesthesia is employed by aid of a spray of rhigolene or ethyl chlorid. Ordinary sterilized bonnet-needles are forced into the lumbar muscles, where they are allowed to remain for about ten minutes. The painful points in the muscles are punctured. Usually the relief is immediate, although it may be necessary to repeat the maneuver at several sittings.

Acupuncture is indicated in chronic as well as acute cases of lumbago. I have practised the maneuver with much benefit in myalgias in other situations. Thus, in pleurodynia, where it was often impossible for me to say whether a pleuritis was present, cure resulting from acupuncture of the thoracic muscles solved the problem. When the intercostal muscles were involved, an intramuscular injection into the latter of sterile water was equally efficient.

The subcutaneous injection of air to relieve the pain of neuralgias and lumbago, as recommended by Desplats,[208] may be tried, but the writer observes in this method no advantages over simple acupuncture. In this method the needle is first introduced, to insure that a vessel has not been punctured, and then the needle is connected with the pumping portion of an ordinary thermocautery; the reservoir is first distended and the air is allowed to pass gradually into the tissues. It takes several days before the air is absorbed.

Pains in the lumbar region are ordinarily misconstrued by the laity, who refer them to a renal origin. To exclude the latter origin I have recourse to *transmitted palpation of the kidney:* the palm of one hand is in contact with the lumbar region and the dorsum of the latter is struck a series of blows with the fist of the other hand. After this manner renal tenderness may be elicited and myogenic pain excluded.

S. Solis-Cohen employs for the immediate relief of myalgia intramuscular injections of morphin ($\frac{1}{6}$ gr.) and atropin ($\frac{1}{60}$ gr.). This hypodermatic treatment is followed by the internal use of colchicum.

BLOOD-LETTING.

In Le Sage's caricature of the phlebotomizer abundant bleeding and repeated draughts of water were regarded by Sangrado as the secret of health. Bleeding was so inconsistently practised by the past generations of physicians that it merited the rebuke of Van Helmont, that "a bloody Moloch presides in the chairs of medicine." Sweating and purging were also added to the list of therapeutic methods of ridding the body of poisons, and some one thus travestied the practice of Dr. I. Lettsom:

When patients comes to I,
I physics, bleeds and sweats 'em;
Then—if they choose to die,
What's that to I—I lets 'em (I. Lettsom).

Mediolano is responsible for the following concerning venesection:

Exhilirat tristes, iratas placat, amantes
Ne sint amantes, phlebotomia facit.

Blood-letting is one of the lost therapeutic arts. Formerly we bled too much, but now we do not bleed enough. Bleeding a man into his own blood-vessels by our modern drugs, like veratrum viride, is an inefficient substitute. Bouchard claims that by the abstraction of 32 grams of blood more poisonous matter is carried off than in 100 liters of perspiration. For the rapid reduction of dangerous hypertension, venesection is often imperative.

Pathology of the Circulation.—Impairment of the myocardium conduces to a diminished arterial supply of blood and overfilling of the veins. Thus arterial pressure falls and venous pressure rises, and cyanosis and stagnation edema occur. In cardiac inefficiency of the left ventricle the primary manifestation is overfilling of the pulmonary circulation, and when the right ventricle is at fault, there is engorgement of the systemic veins, with a fall of pressure and diminished supply of blood in the pulmonary circulation and aorta. The total amount of blood in the body is not sufficient to fill all the vessels to their complete capacity, hence some organs may contain an excess of blood (hyperemia) and others a diminished supply (anemia). Hyperemia may be active (arterial congestion) or passive (venous congestion). In *plethora* there is an augmentation in the quantity of blood—a condition associated with over-eating or over-drinking, which leads to hypertension and early arteriosclerosis.

Now, the physiologists claim that the so-called "full-blooded" condition of the patient, to which the older clinicians ascribed so much pathologic importance, does not in reality exist, for in animal experiments an increase in the volume of the blood produces only temporary changes in the circulation; that the blood-pressure soon becomes normal, owing to compensatory dilatation of the abdominal vessels and increased elimination of fluid through the kidneys and intestine. Clinicians, however, maintain, despite the contrary evidence of physiologists, that the quantity of blood may be increased in plethora and diminished in anemia. Plethora is expressed by a hyperemia of the surface of the body, an excess of fat, enlarged heart, full pulse, and capacious arteries.

The older clinicians recognized the *apoplectic habitus*, in which certain prodromes of cerebral hemorrhage occurred, viz., vertigo, headache, numbness of one side, and fullness in the head, and that such symptoms were best combated by limiting the quantity of food and fluids ingested and by blood-letting. The relief by blood-letting of the foregoing cephalic symptoms suggests the diagnosis of cerebral congestion.

Physiologic Action of Blood-letting.—Practically all the components of the blood are reduced, but are restored within fourteen days after a moderate venesection. The pulmonic circulation is primarily depleted and the pressure in the veins falls. Some claim a reduction and others an increase in arterial pressure. The velocity in the blood in the capillaries is increased. Tappeiner found that one-fifth of the total blood volume could be lost, and within a limited period the pressure attained a sufficient height to support life. The amount of blood to be withdrawn is usually reckoned after the following formula: 1 to 3 grams of blood to every pound of the weight of the body. The quantity of blood in the adult is about one-thirteenth of the weight of the body. The average quantity of blood to be withdrawn is from 300 c.c. (10 oz.) to 400 c.c. (13 oz.). An approximate estimation of the distribution of blood to the body is as follows: One-fourth to the lungs, heart, and large blood-vessels, one-fourth to the skeletal muscles, one-fourth to the liver, and the remaining one-fourth to the other organs. When the action of the heart is feeble, blood does not flow readily, hence venesection must be preceded by an injection of caffein.

Diagnosis.—Venesection has a wide range of application for diagnostic purposes. Hemorrhages in typhoid fever and phthisis are really due to a plethora, and may be averted, if recurrent, by venesection. It may also be tried to reduce high blood-pressure, to eliminate toxic products from the blood, and to relieve the burden of overworked organs. The relief of cardiac dropsy by skin incisions is not due so much to the escape of serum, as Devoe suggests, but to the removal of blood, hence the incisions are also made with the latter object in view. In *diseases of the blood*, notably chlorosis and polycythemia, venesection may be indicated. It has been noted that the loss of blood stimulates the formation of new blood. Symptoms dependent on *plethora* are unquestionably benefited by blood-letting, and the latter may be repeated from time to time. Circulatory disturbances dependent on inefficiency of the heart or lungs are likewise influenced. Puncture of the heart (cardiocentesis) and abstraction of blood is an heroic maneuver. Many Anglo-Indian physicians practise hepato-phlebotomy by aspirating about 18 ounces of blood directly from the liver, and good results are reported. Acute *pulmonary edema* is often promptly combated by venesection, which abstracts toxic substances, diminishes venous tension, and reduces cardiac embarrassment. In studying the question of blood-tension, in either diagnosis or treatment, one must not forget that one of the factors in blood-pressure is the volume of circulating blood.

Congestive Neurasthenia.—Whittle, of London, in 1889 wrote an interesting brochure on this special form of neurasthenia, but it seems to have escaped serious consideration. I have been able repeatedly to confirm the observations of Whittle. He described a form of nerve-depression resulting from brain-congestion, and illustrates the remarkable efficacy of blood-letting, by either leeches or venesection, in its treatment. The particular patients who are thus benefited have flushed faces, watery eyes, and complain of a lightness in the head, with occasional aching of a dull, heavy character about the forehead. The majority of cases occur between the ages of thirty and forty, and more frequently in males than females. The most constant factor in its production is continuous brain-strain. In these cases I abstract the blood from the nose by making several punctures of the nasal mucosa. Pain is prevented by the use of stovain to the mucosa. The latter dilates the blood-vessels and encourages bleeding. Cocain prevents bleeding because it induces an anemia of the parts. When bleeding is prematurely arrested, remove the clots from the nasal incisions by means of cotton wound around a probe and moistened with water and have the patient lean far forward to encourage the flow of blood. Amyl nitrite inhalations may also increase the flow. One knows that there are apertures in the cranium (emissary foramina) giving passage to venous connections between the external veins of the head and the cerebral sinuses. By means of these channels infection may be carried to the sinuses, causing thrombosis or meningitis. Intracranial congestion may be relieved by the application of leeches to the emissary foramina, which are usually situated as follows: (1) The parietal foramen, to either side of the sagittal suture in a line connecting the parietal eminences, which leads to the superior longitudinal sinus. (2) The mastoid foramen, connecting the occipital veins with the lateral sinus. It is the largest and most constant of all the emissary foramina, and is situated above the base of the mastoid process, two fingerbreadths behind the external auditory meatus.

One may remark parenthetically that in Arabia the neck is inclosed in a bandage sufficiently tight until the veins of the face are brought into prominence, and the vein at the root of the nose is selected for venesection.

Local congestion is productive of many symptoms, and to eliminate this factor in diagnosis the use of leeches and cupping (dry and wet) are indicated.

To equalize the circulation, and thus hasten the elimination of toxic agents from congested areas, nothing is better than nitroglycerin, and to maintain the action of the latter it is combined with atropin. It is often marvelous to note in some instances the immediate effects of such vascular dilators on certain symptoms. Venesection is often necessary before digitalis will act properly as a cardiac tonic. One knows that a congestive headache is accentuated during recumbency; that elevation of a limb will diminish the pain of a felon or the pain of a joint-inflammation.

When *leeches* are employed, they must not be applied to regions containing loose cellular tissue (prepuce, scrotum), to avoid subsequent swelling and discoloration. They must not be applied to the face, owing to the subsequent permanent triangular scars, over a superficial artery or vein, or directly over an inflammatory area. Some clinicians apply leeches at a distance from the part affected (anus or coccyx), on the principle that in cerebral hyperemia the symptoms are spontaneously relieved by hemorrhoidal bleeding, whereas profuse bleeding from the nose is without influence.

Renal pain may often be relieved by cupping, and the best point of application is over Petit's triangle (area bounded by crest of ilium below, latissimus dorsi and external abdominal oblique on each side), where the veins in this area anastomose with the veins of the capsule of the kidney.

CATHETERISM.

Guyon, in his "*Maladies des voies urinaires,*" makes the pertinent statement, "that to determine the indications for catheterism is a thing even more difficult than its proper execution."

Functions of the Bladder.—The normal bladder reflex (Fig. 41) is as follows: When urine accumulates in the bladder, the tract *A'* to *a* is stimulated, and the stimulation is conveyed to the sphincter center, *B*, which sends an impulse to the sphincter *b'*, which closes the bladder more powerfully. With further accumulation, a more intense stimulation is conveyed to *a*, and then an impulse passes to the muscular coat of the bladder (detrusor urinæ) along line *c c'*, and the bladder will be emptied. Above the bladder-center one notes certain tracts: (1) *a* to *A'* is the sensory tract to the brain, which furnishes information concerning the fullness of the bladder. (2) *B B b'* represent the tract for the voluntary innervation of the sphincter. (3) *B* to *b'* is the tract which presides over the voluntary emptying of the bladder. (4) The tract *D* to *D* conveys impulses

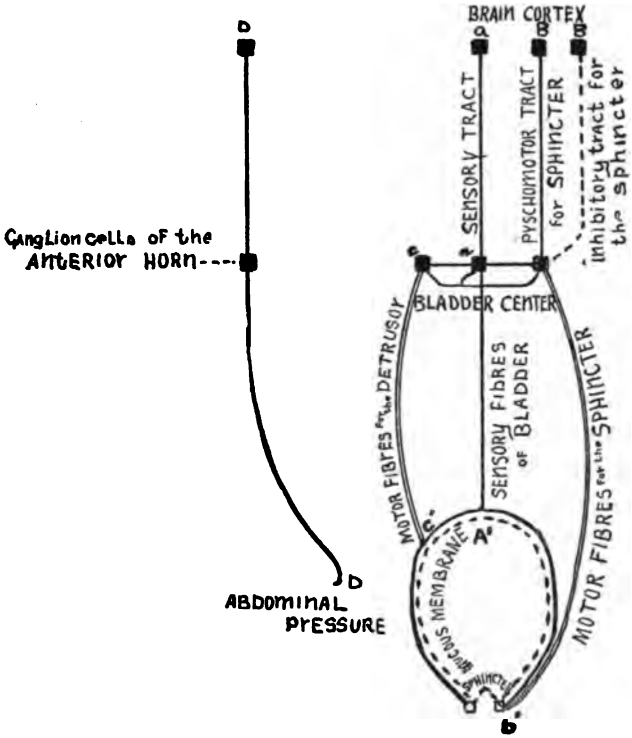
BRAIN CORTEX
a
B
B
D
SENSORY TRACT
PYSCHOMOTOR TRACT for SPHINCTER
inhibitory tract for the sphincter
Ganglion cells of the Anterior Horn
c
a
BLADDER CENTER
MOTOR FIBRES for the DETRUSOR
SENSORY FIBRES of BLADDER
MOTOR FIBRES for the SPHINCTER
c'
A'
MUCOUS MEMBRANE
SPHINCTER
D
ABDOMINAL PRESSURE
b'

Fig. 41.—Scheme for the physiologic mechanism of the bladder-functions. *Vide* text (after Sahli).

from the brain to the abdominal muscles which aid in emptying th bladder.

In cerebral diseases the bladder reflex may operate automat cally, independent of consciousness, or the reflex may be abolishe in which case there is primary retention of the urine and subs quently an overflow of the distended bladder, leading to incont nence. In diseases of the spinal cord three things may happe (1) The bladder-center is affected and the sphincter and detruso reflexes are abolished. The bladder acts like a bag and retentio and incontinence of urine occur. The urine accumulates until th intravesical pressure is sufficient to overcome the urethral contra tion, when incontinence follows. Here the catheter demonstrate bladder paralysis, because there is no opposition to the entrance o the catheter into the bladder, in consequence of the absence of th sphincter tonus. One is also able to express the contents of th bladder by pressure over the latter in the lower abdominal regio (2) The bladder-center is unaffected but the tracts conductin impulses to the brain are involved. Here voluntary emptying of th bladder is partially or totally abolished. The patient is not con scious of a filled bladder and there is primarily retention followe by incontinence. (3) When the lesion is below the bladder-cente the reflex arc of the bladder is interrupted, and the results corre spond to a lesion of the bladder-center.

Among the *neuroses of the bladder* we have cystospasm o spasm of the bladder. In detrusor spasm evacuation of the bladde occurs suddenly, due very often to hyperirritability of the bladde mucosa, and is a frequent cause of incontinence in children. I spasm of the sphincter the orifice of the bladder is forcibly closed and this closure often becomes more pronounced with furthe accumulation of urine. In this condition the urine can only b discharged with great effort, and then only a small quantity at time. Spasm of the sphincter forcibly resists the introduction of catheter. Spasm of the detrusor and sphincter muscles may co exist. Now, these neuroses may occur in consequence of affection of the brain, cord, modifications of the sensibility of the bladde mucosa, and in affections of the deeper urethra and prostate There is likewise a neurosis of the bladder associated with anesthe sia of its mucosa, in which the patient is not conscious of urine i the bladder and there is at first retention followed by incontinence.

Diagnosis.—A normal individual urinates about five times in twenty-four hours. Thus, with an average excretion of 50 ounces of urine in twenty-four hours, the average capacity of the bladder is about 10 ounces of urine. The sensibility of the bladder mucosa is tested by means of a sound or a rigid curved catheter. Here the pain of the instrument in the urethra should be excluded by cocainization of the latter. To test for *residual urine*, have the patient pass the urine in the usual way and then introduce a catheter. If urine passes through the catheter, the bladder is incompetent and the amount of fluid (measured) represents the residual urine. The amount of residual urine, according to J. W. White, serves as an index for the frequency of catheterization: if it amounts to 4 ounces, a soft catheter is used night and morning; if it amounts to 6 ounces, the catheter is used every eight hours; and if the amount is 8 ounces, use must be made of the catheter every six hours. The urine passes through the catheter either slowly and feebly or with the normal force. In the former instance there is atony of the bladder, and in the latter the muscular power of the bladder is intact, but there is some obstruction to its outflow, as occurs in hypertrophy of the prostate or in urethral stricture.

Frequent micturition may be due to a multitude of causes, dependent on an increase of the bladder reflexes due to local causes resident in the bladder, prostate, or urethra, disease of the cord, and affections of the kidney. If increased frequency of urination occurs as a result of an augmented secretion of urine (polyuria), the estimation of the secretion in twenty-four hours would determine this fact. Not infrequently frequent urination (pollakiuria) may be due to a bladder of diminished capacity. The latter is suspected when pollakiuria is chronic and the tone of the bladder musculature is not compromised. One can estimate the capacity of the bladder by means of a sound or by injecting fluid into the bladder and noting the resistance to the entrance of the fluid and the quantity that can be introduced. A normal bladder tolerates an injection of 200 to 250 c.c. of fluid. When the urine ceases to flow through the catheter, and when the latter is pushed further into the organ or to one side and more urine flows, a sacculus may be suspected, especially if it differs in character from that firs drawn. If a catheter is combined with a piston syringe, the capacity, distensibility, and contractility of the bladder may be determined. Thus, if an abnormally large quantity of fluid can be injected without eliciting resistance, vesical atony is present, or possibly rupture. In inflammation of the bladder there is a lack of distensibility owing to forcible contraction of the bladder, bu if a solution of cocain has been previously injected, it will easily accommodate the intravesical injection.

Anomalies of micturition are classified as follows: ***Anuria*** refers to an absence of urinary secretion (nephritis) or its retention (bilateral nephrolithiasis). ***Oliguria*** refers to a deficient secretion of urine even though micturition is frequent. ***Polyuria*** signifies an increase in the quantity of urine (diabetes). ***Pollakiuria*** refers to frequent urination, irrespective of the quantity, and occurs in affections of the prostate (residual urine) and bladder and when the quantity of urine excreted is in excess of the normal.

The Three-glass Catheter Test.—It is often difficult to determine in urethritis whether the pus and shreds are derived from the anterior or posterior urethra or bladder. Wolbarst[88] suggests the following simple maneuver: Wash out the anterior urethra by means of a syringe until the return fluid is clear—glass No. 1; this shows the condition of the anterior urethra. A soft sterile catheter of small caliber is now passed into the bladder and the contents are drawn off into glass No. 2; this shows the bladder urine plus any possible drippings from the posterior urethra or any urethral detritus carried in by the catheter; the catheter being still in the bladder, the latter is washed until the washings come out clear; this demonstrates that the bladder contains no foreign elements; about 8 ounces of clear fluid is injected into the bladder and the catheter removed. The patient now passes 2 ounces of urine into glass No. 3, which shows the condition of the posterior urethra. The prostate may now be massaged, after which about 2 ounces of urine is voided into glass No. 4, which yields the elements from the prostate. Instrumentation is not always desirable in urethritis, hence many of us would content ourselves by adopting the conventional maneuver of first washing out the anterior urethra and then having the patient void his urine. Shreds and pus present in the urine come from the posterior urethra or bladder, but differentiation in the latter instance is rarely necessary unless a bladder coexists with a urethral lesion.

In false or *accidental albuminuria* the albumin found in the urine is derived from some albuminous exudate in the urinary tract. Prior washing of the urethra may be necessary to exclude such accidental forms, or the urine is withdrawn from the bladder by a catheter. In females one may practically always obtain the reaction of albumin in the urine, owing to the accidental presence of vaginal secretions, hence previous lavage of the genitalia is always necessary before a sample of urine is obtained for examination or a specimen is secured by the catheter. The use of a vaginal tampon before micturition has the same object in view.

The following simple method is available for determining whether *pyuria* is of renal or vesical origin: Wash the bladder thoroughly and then empty the bladder while the catheter is retained. Compare the urine which is subsequently collected from the catheter with the urine before washing. If the former is as cloudy as the latter, the pus comes from one or both kidneys; if the urine is clear, the pyuria is essentially of vesical origin; if it is clearer, but still contains pus, it is probable that the kidneys as well as the bladder are implicated in the pyuria.

Renal and Vesical Hematuria.—Thompson's method for determining whether the blood comes from the kidney or not is to introduce a soft catheter gently just within the bladder neck, draw off the urine, and wash out the cavity very gently with tepid water. If the water cannot be made to flow away clear, the inference is that the blood comes from the cavity of the bladder. If the water can be made to flow away clear, the catheter is corked for a few minutes, the patient being at rest, and the first small quantity of urine which collects drawn off and examined. If this quantity of urine is bloody, and if after again washing the bladder the water comes away clear, the inference is that the blood is from the kidneys.

Vesical hematuria dependent on excessive vesical contractions may often be arrested by placing the bladder at rest, and this is best attained by the introduction of a permanent catheter. The employment of the latter is therefore valuable in diagnosis and treatment.

To detect *feigned anuria*, catheterize at a certain hour, and employ the catheter again after three hours, when the patient is unprepared for a repetition. The author has detected hysterical retention of urine by noting that the mere introduction of the catheter slightly beyond the meatus (without reaching the bladder) suffices to empty the bladder.

CLIMATOTHERAPY.

The average adult utilizes in twenty-four hours about 10,000 liters, and every hour about 400 liters, of air. The principal ingredients of the atmosphere are oxygen, nitrogen, and carbonic acid. The composition of the inspired and expired air may be compared as follows (Kirke):

	Inspired Air.	Expired Air.
Oxygen	20.96 vols. per cent.	16.03 vols. per cent.
Nitrogen	79.0 " "	79.0 " "
Carbonic acid	0.04 " "	4.04 " "
Watery vapor	Variable	Saturated.
Temperature	"	That of body (37° C.).

The percentage of oxygen in the atmosphere is practically constant, irrespective of location. By aid of respiration the oxygen is chemically bound by the hemoglobin, whereas a limited amount is absorbed by the plasma. The percentage of ozone in the atmosphere is greatest during the months of May, June, and July, and least during the months of November, December, and January. It is a powerful oxidizing agent, and by destroying organic matter contributes to the purity of the atmosphere. In the atmosphere the percentage of carbonic acid is small, but in dwellings it may increase in dangerous amounts, as a result of imperfect ventilation, from charcoal stoves, and in fermenting rooms in the alcoholic fermentation of saccharine fluids. The presence of plants in a room may favor atmospheric purity during the day by absorbing CO_2 and giving off O, but at night this interchange of gases is reversed. Sea-air contains traces of salt and iodin.

Micro-organisms and dust in the atmosphere are undoubted factors in the etiology of disease. Tyndall and Aitkin first demonstrated that mountain-air rarely contains more than 200 dust-corpuscles in a cubic centimeter, whereas in proximity to villages the number increases to 1000, and in large cities to 100,000 or more. Sea-air contains less dust than land-air, and the number of germs diminishes in proportion as one recedes from land, until eventually none are found.

Temperature is not without influence in climatology. The experiments of Van Oordt show that cool temperatures on the nude body are equivalent to hydrotherapeutic maneuvers with the same temperature.

The action of *light* is to augment the consumption of oxygen and the elimination of carbonic acid. It is during the developmental period that light exerts its most potent influence. Thus it is that in children bodily growth is retarded during the sunless months, and in adults the growth of the hair and nails can be influenced by the admission and exclusion of light. Light-hunger is a potent factor in disease. Light is an agent in hastening chemical change.

> "The glorious sun
> Stays in his course, and plays the alchymist;
> Turning with splendor of his precious eye
> The meagre cloddy earth to glittering gold."

Sun-worship was always the essential factor of polytheistic religions; and of the several mythologies, the chief deities were personifications of the sun or of its particular effects. While the declining sun symbolized death, the mid-day brightness was emblematic of power. Intuition taught the Incas how closely the sun was identified with life and its preservation. It has been suggested that the curative virtue of *quinin* depends on its fluorescence, whereby it floods the blood with light and makes it an unsuitable habitat for the malarial organism. It was shown that the blood and most of the tissues are slightly fluorescent, and that in malaria this fluorescence is reduced, and is increased by taking quinin. It has even been suggested to use sun-baths or electric-light baths with quinin in malaria. Morton has availed himself of the fluorescent property of substances like esculin, quinin, resorcin, etc., by introducing solutions of them into the body, and then exposing the particular part to the action of the *x*-ray or radium, which causes the substances in question to take up light and thus bathe the internal organs in liquid "sunshine." Johann Müller could not think well in the dark, and Goethe wrote: "The first hours in the morning I have consecrated to poetry; the day belongs to the affairs of the world." One remarks the anemi of individuals suffering from light-hunger, and in all probability th hemoglobin percentage is reduced when there is poverty of light We know that light induces erythema and pigmentation, and tha the latter is probably a protection against the excessive action of th rays. In 1899 I demonstrated[80] that the solar rays could be mad to penetrate the skin, and that the power of penetrability was assisted by moistening the skin after anointing it with lanolin. A that time it was also shown that the rays were capable of exercisin their bactericidal action almost to their point of penetration Later Kime demonstrated that light could pass entirely throug the adult chest. There are many other factors concerning climate like soil, winds, temperature, humidity, etc., which must be take into consideration.

Physiologic Action of Different Climates.—Comparing th sea with the inland climate, one notes that in the former the dail fluctuations in temperature are less marked. Sea-air contain relatively more oxygen and less carbonic acid, microbes, and dust Respirations are diminished in frequency and the inspiration deeper. Perspiration and the urinary secretion are increased The moist warmth of island and coast climates, like the Azores Cuba, Florida, Jamaica, etc., has a sedative influence and act favorably on the mucosa of the respiratory organs. The climat of high altitudes is associated with dryness and low pressure. Th immediate effects of residence in high altitudes is to increase th breathing and the pulse-rate, but later both are reduced to normal Climate is something more than a mere mechanic mixture of oxyge and nitrogen. What that something is we do not know; we ma call it atmospheric electricity or radioactivity, but it exists nevertheless. When an asthmatic obtains relief by changing his room fro one part of his dwelling to another, or by moving across the stree or to another neighborhood, we are powerless to discover by ou analytic methods why this occurs. If we only could, we would b able to create for an asthmatic an atmosphere conducive to his well being. So it is with consumptives; the attributes of climate whether modified by elevation, dryness of the air (absolute an relative), temperature, sunshine, winds, soil, atmospheric electricity, etc., certainly influence the progress of their disease. "Th empire of climate is the most powerful of all empires." Dexter[90] has essayed in his book an empirical study of the mental and physiologic effects of meteorologic conditions. In a living organism a part of the available energy is necessary for the vital processes of living, while the reserve energy goes into the intellectual processes. Weather conditions play on the reserve energy by affecting oxidation, which is the chemic basis of life. Inhabitants of hot climates are apathetic and improvident. An equable, moist temperature weakens body and mind. The most favorable temperature for health, with its aggressive energy, is about 55° F., and this is found in the temperate zones. The dominant people are shown between the 25th and 55th parallels. The effect of weather upon human conduct is marked by fluctuations of immoral acts. We find ourselves out of sorts on hot, humid, cloudy, and perhaps rainy days. We also know the influence of weather in the etiology of *barometric neuroses*.

Diagnosis.—A wise man once said, "Those things which we use most and oftenest have the greatest influence on health, and water and air are of this nature." In the practice of medicine, one must constantly recall the truism, "Laboring art can never ransom nature from her inaidable estate." One rarely thinks of prescribing fresh air unless it be in association with phthisis. The reason is evident—there are no trustworthy signs indicating air-hunger (*vide* respiratory exercises). True, we recognize instances of acute air-hunger in our dyspneic patients, but the chronic cases pass unnoticed. Many individuals are in a permanent state of asphyxiation, and forced air-feeding is the only remedy. Catarrhal affections of the respiratory apparatus are infections, not "colds." The latter merely predispose to infection. Infection occurs from the inspiration of a dust-laden atmosphere saturated with germs. In sneezing, coughing, and talking we are constantly contributing to air-infection. We go to places of public assembly, and after subsisting on a liberal respiratory dietary of germs, inconsistently express surprise that we have contracted a "cold." We ventilate and dust our living-rooms, and do it in such a way as to abet infection. Careful investigations have demonstrated that if the air of a tightly closed room is charged with bacterial dust, within three hours all the bacteria settle to the floor and the air becomes germ-free. The renewal of air in a room as in ordinary ventilation does not remo the germs, nor does the opening of windows when the air is blowi The most effective plan of rendering the air of a room germ-free to close it for three hours, when the dust will accumulate on ho zontal surfaces, when it can be removed by moist mops. Carpet floors can be covered by moistened sheets of paper, which gatl and fix the dust. Anything which will set afloat the dust must avoided, hence the absolute interdiction of the "duster" or distri utor of dust and dry sweeping. In normal breathing through t nose the nasal passage acts as a filter, but in mouth-breathing the is no filtration and infection is encouraged. An individual, ch or adult, often loses the tendency to "catching cold" by the corre tion of a nasal obstruction (consult chapter on the diagnosis visceral sufficiency).

The open-air treatment of pneumonia, now successfully e ployed at the Presbyterian Hospital and at the Fordham Hospi in New York, merely emphasizes the curative value of air, irrespe tive of the nature of the disease. Fresh air is a specific in phthis The specificity has been demonstrated with the same certainty mercury in syphilis and quinin in malaria. The environme experiment of Trudeau, so frequently cited, is an admirable exa ple, showing the value of pure air for the consumptive. Trudea after inoculating rabbits with tuberculous virus, confined some them in a dark damp place; these died rapidly, while of othe permitted to run wild, many recovered. In the treatment of re piratory affections we have heretofore been counseled to preserve constant temperature, not below 70° F., to avoid the dangers draughts and exhaustion due to radiation of heat, but now a chang less temperature is regarded as enervating, and a variable temper ture as stimulating by hastening metabolic activity.

Climate offers to the *asthmatic* the easiest route for a cure, or least relief over a great period of time, but unfortunately all patien cannot indulge in this luxury, which means permanent residen in a locality which conduces to freedom from attacks. Clima can only be prescribed in a general way, and in this respect eve asthmatic is a law to himself. Until atmospheric conditions a better understood it is impossible for a physician to prescribe definite locality. He may, in a general way, suggest a locali where the soil is dry, and where winds, fogs, and dampness do not prevail. One patient may secure immunity in a town with a smoky atmosphere; another at the seashore, and still another at some high altitude. After a period of time when acclimatization is established the asthmatic attacks usually recur. The case of a physician is cited by Knight, who changed his residence several times during his life on account of asthma, and who eventually secured relief by going back to the place from which he started. It is the asthmatic with a pronounced neurotic element who is so capricious concerning climate and atmospheric conditions. In suggesting climate, the physician must take into account the attendant evils of asthma, viz., dilated heart, bronchitis, and emphysema. In emphysema, for instance, residence in high altitudes only accentuates the symptoms. Reference has already been made to the diagnostic value of climate in spasmodic bronchostenosis. The latter affection corresponds to the description of *catarrhe sec* of Laennec.

Attention has also been directed to hay-fever. There are two classes of cases: one class begins in the latter part of May and June, at a time when roses are in full bloom; and the second class, the common variety, in August, during the time that the common ragweed is in bloom. In these cases removal from one place of dwelling to one free from the source of irritation is diagnostic and curative. An ocean voyage before the expected attack may prevent it, and if the patient has the disease and takes an ocean voyage, the attack usually ceases the second or third day out.

Disturbances of Metabolism.—One knows that in *chronic rheumatism* a dry, stimulating climate may result in spontaneous cure, whereas a damp atmosphere and seaside climate accentuate the manifestations. Thus it is that when the nature of pains is undetermined, the relief secured by residence in a dry climate may reveal their rheumatic character. In *gout* a dry, equable climate is also advantageous. In the presence of a cold east wind the subject often declares that he feels "gouty." In *diabetes* the avoidance of pulmonary complications is of great importance, hence the diabetic should have all the advantages of a warm, dry, and protected locality. *Scrofula* is now definitely regarded as tuberculosis manifestly limited to the lymph-glands. This disease is best treated, like phthisis, by forced feeding and fresh air, and sea air is almost specific in its action. *Rachitis* is a disease initiated by a and light-hunger. Some one averred that, "If he knew what pr duced consumption he could cure it." Now, in rachitis, like co sumption, our treatment is in an allopathic direction—*i. e.*, v introduce the patient to conditions incompatible with the diseas Exclusion of pure air, sunshine, and depletion of the organism l nutritive disturbances are the legitimate avenues for many met bolic disturbances, and are tantamount to the famous recipe Ricord for acquiring gonorrhea.

Diseases of the Circulatory System.—In insufficiency of t cardiac muscle residence near the sea-level in a moderately war climate is indicated. A cold climate causes contraction of t peripheral blood-vessels and increases the work of the hea Further, a cold climate necessitates increased heat-productio which likewise augments the work of the heart. A high temper ture may reduce blood-pressure, and thus leads to cardiac enfeebl ment. High altitudes are not suitable for cardiopaths. Indee there are individuals with latent cardiac affections who are fi apprised of their infirmity by dyspnea, palpitations, and arrhyt mia during their sojourn in a high altitude. In this connecti one may make mention of the investigations of Hasselbalch, director of the laboratory of the Finsen Light Institute. He h determined the lasting results of the exposition of the naked bo to a strong electric light. By means of exact methods he has su ceeded in proving that the hyperemia of the skin produced by t light-bath is accompanied by a considerable diminution in the ra of respiration, and that this decrease may persist for many da after the bath. Another and yet more important fact is that t average blood-pressure in the brachial artery decreases to t amount of 8 per cent. after the light treatment. This diminutio of the blood-pressure has a fixed minimum value for a given lig source, below which the pressure does not sink, although the ligh treatment be continued. The decrease of the arterial pressure caused by dilatation of the peripheral vessels, and may persi more than a month after the light-baths are discontinued. It wi easily be seen that these results of the light treatment, if constan may be of great importance in the treatment of heart diseases. diminution of the blood-pressure, produced by a dilatation of th peripheral vessels, has the effect that the work required of the heart also becomes lessened, and that the area of heart dullness is diminished. In other words, we have here a therapeutic agent that works in the same way as the carbonic acid bath (Nauheim cure), but with the valuable difference that it is followed by a far more pronounced and lasting dilatation of the peripheral vessels.

Digestive System.—This is stimulated by a cool climate and depressed by a hot one. During the winter months or in a cool climate more food is ingested, digestion and assimilation are improved, and the body gains in weight and vigor. In warmer climates the heat depresses the digestive apparatus, and, in addition thereto, one must consider the changes in the food itself.

Nervous System.—Warm climates are soothing and cool climates stimulating to the nervous system. On account of the cool nights in the mountainous districts, refreshing sleep can often be obtained. The question of climate for a *neurasthenic* must naturally be controlled by the environment where sufficient diversion can be secured. Keller recommends hill-climbing for neurasthenics. I mention this recommendation only to condemn it. Every function of the body is controlled and operated by the nervous system. The latter, which dominates the functions of the mind, likewise controls the action of the muscles. We have not two nervous systems nor two brains, and it is this mistaken conception of the functions of the nervous system which has made confirmed neurasthenics out of individuals who have expended too much nerve-force in excessive muscular development under the supposition that they were developing their minds. If the theory of muscularity were correct, intellectual giants would be recruited from dray horses and pugilists. When a neurasthenic comes to me, I make him give me a detailed account of how he apportions his day. Here and there I note unnecessary expenditure of muscular energy, and the latter is interdicted. Thus the individual may accumulate considerable reserve force, and the energy thus saved in a month is tantamount to a brief rest-cure.

The nerve exhaustion of the tropics, or *tropical neurasthenia*, is supposed by Woodruf to be due to overstimulation by the excessive quantity of actinic rays present in tropical sunshine. Fales[221] estimates from his observations in the Philippines that many of the

American women (50 per cent.) and the men (30 per cent.) v have been in the islands for a year or more are in a state of se invalidism. It is stated that change of climate is usually effec in the treatment of such patients. My experience with these ca has been that they do not respond to a change of climate; in f neurasthenia is neurasthenia, whether developed in the tropics elsewhere, and if its etiology is a tropical climate, the remova the cause is often no more effective than the removal of the conv tional causes of the disease. There is no doubt but what ne asthenia is more prevalent in tropical than in temperate clima among the foreign residents, for the evident reason that Occide methods of living are not consistent with tropical climates. M writers, notably House,[264] direct attention to the fact that sana iums in the cloudy and cold north are remarkably successful in treatment of neurasthenic states. Patients from sunny clima improve as soon as admitted. Sometimes three weeks mak remarkable change for the better and an apparent cure, but patients relapse as soon as they return home. In addition, Ho states that three days of sunshine will make maniacal patients r less and talkative and aggravate their condition, but that t improve with cloudy weather. It is quite evident, then, accord to House, that neurasthenics and all cases of mental excitem should be sent north to cool or cold cloudy climates. They remarkably well in the mountains of New York, but get wors the sun-baths of the south. If removal is impossible, they sho be shielded from the light. Dr. Allen McLane Hamilton obser that for many years he has advocated the use of the darkened ro for several hours daily, with a few hours of cheerful sunshine the psychic effect), in his "rest cases," and they have impro when they would not under the conventional and popular treatm of "plenty of sunshine and fresh air." Other writers comm on the damage done to nervous patients by the stimulation of h altitudes, and advocate the soothing climates at low levels, v plenty of clouds and moisture.

In affections of the *kidneys* cold and moisture prove inimica the patient, hence a dry and warm climate is indicated. Suc climate, by promoting the cutaneous functions, imposes less w on the kidneys.

CYSTOSCOPY.

The cystoscope is of great importance in the diagnosis and treatment of diseases of the urinary organs. One may note directly inflammation of the bladder mucosa, ulcers, foreign bodies, tumors, trabeculations, and sacculations. Vesical calculi may be seen in sacculations, and even the composition of the stone may be determined. As the jets of urine escape from the ureteral orifices, one may note the presence of pus or blood, and thus ascertain which kidney is involved. With the operating cystoscope, calculi, polypi, even tumors may be removed. The ureteral catheter enables us to diagnose with greater accuracy morbid conditions of the ureter, renal pelves, and kidneys. With the observation cystoscope alone, it is often impossible to say whether pus emanates from the ureteral orifice or higher up. If the ureteral catheter is passed beyond the ureteral orifice and pus is obtained, one knows that suppuration

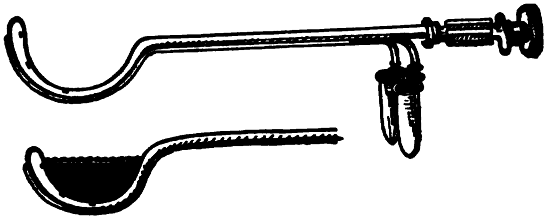

Fig. 42.—Luys' separator.

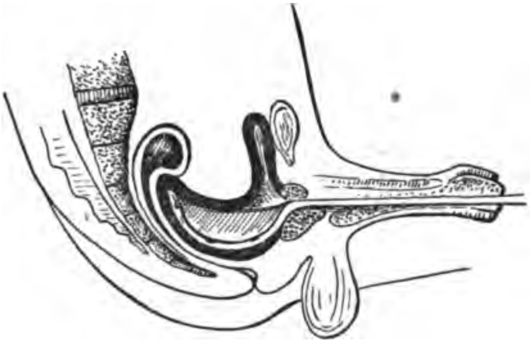

Fig. 43.—The separator in the male bladder.

exists beyond the ureteral meatus. If the catheter is passed tc renal pelvis and clear urine is obtained, then suppuration is lin to the ureter. If pus is obtained from the ureter as well as the r pelvis, it is evident that the entire tract is implicated. Occas ally no urine is obtained from the lower part of the ureter, upon further introduction of the catheter an obstruction is enc tered which, when passed, results in the escape of urine. In latter instance one infers obstruction of the ureter, intra- or ex ureteral, or the presence of a calculus. By means of a wax-tip catheter ureteral or pelvic calculi may be detected. If there kink of the ureter and the introduction of the catheter is diffi it may be made to pass by having an assistant lift the kidney.

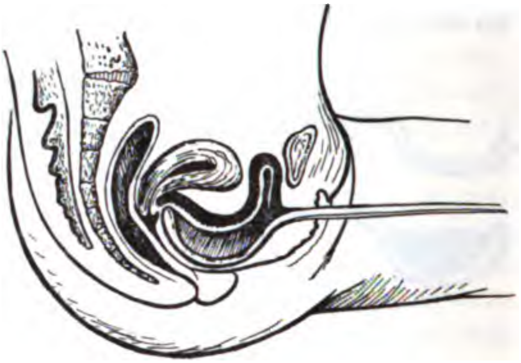

Fig. 44.—The separator in the female bladder (after Fenwick).

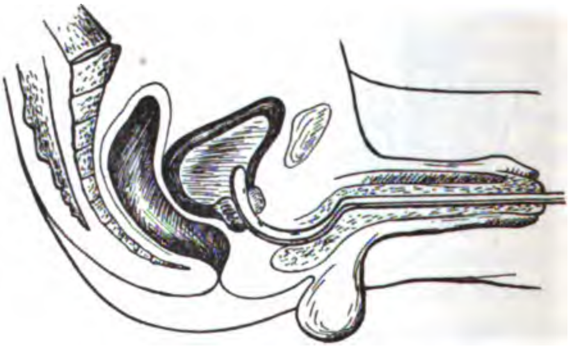

Fig. 45.—Separator in a dangerous position (after Fenwick).

Urinary separators may be less accurate than ureteral catheterization, but they are certainly less dangerous and less difficult to employ. No matter how skilful the expert may be, he cannot avoid carrying septic material to the pelvis of the kidney or injuring the ureteric tube by the ureteral catheter. The Luys separator, for obtaining urine from either kidney, is now in use by specialists and is easily managed. A small instrument is made for children. The instrument (Fig. 42) is a double-channeled catheter with the eyes on the side and curved like a prostatic catheter. By aid of a screw, a diaphragm of india-rubber is raised vertically along the curve of the catheter. When in the bladder with the septum raised, that organ is divided into two lateral halves (Figs. 43 and 44). The patient drinks half a bottle of mineral water, and after the urethra is cocainized, the instrument is introduced and the diaphragm raised by turning a screw at the end of the handle. The urine is then allowed to flow away and the patient elevated to a sitting posture. When the urine begins to flow drop by drop from either spot, it is collected in small tubes, and in about twenty minutes sufficient may be obtained for examination. There is little inconvenience attending the maneuver unless, as Fenwick shows, the curve of the instrument is engaged in the membranous and prostatic urethra (Fig. 45). One must note that the india-rubber is new and has not lost its elasticity. The curve of the instrument must be placed between the ureteric orifices and forced against the bladder base. One may conclude that the instrument is properly employed when one discharge tube furnishes a normal and the other a pathologic urine. If both urines are pathologic and show no dissimilarity, the likelihood of an incomplete separation must not be forgotten, and the instrument reintroduced, or the cystoscope must be used. Cathelin's instrument is also highly regarded, and by some considered more efficient than the separator of Luys, although the sound is larger.

Segregation of the urine by the Harris method is also employed, but the septum may not be perfect, and the urine from one side may become mixed with the urine of the other side. The double catheter is passed into the bladder and the lever is inserted into the rectum of the male and the vagina of the female (Fig. 46). The lever raises the floor of the bladder between the separated ends of the divided catheter and forms a longitudinal watershed between the ureteral orifices. By means of the bulb the urine is made to pass into the vials as fast as it escapes from the ureters. Before using the apparatus, the bladder is irrigated with sterile water, allowing 150 c.c. of fluid to remain in the bladder.

Some skill is always necessary in the use of the segregator. Thus, a case is recorded in which urine came from both sides of the segregator although the patient had only one kidney.

Heusner collects the urine from each kidney by an apparatus which is designed to make pressure on the ureters through the abdominal wall.

The differentiation of *appendicular pain* and that of a movable kidney is accomplished by Kelly as follows: Each ureter is catheterized separately, and into each catheter as much fluid is injected as the renal pelvis will hold without causing pain. The fluid from each side is measured, and when it is in excess of an estimated average, dilatation has commenced. By deliberately injecting fluid into the kidney for the purpose of producing pain, the patient is able to recognize whether the pain caused by the distention corresponds to the pain ordinarily felt.

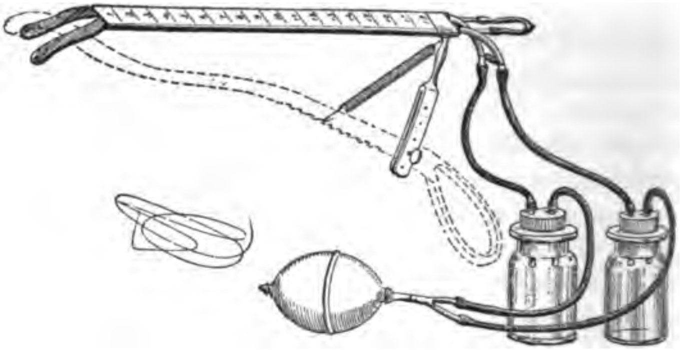

Fig. 46.—Harris's instrument fitted for use.

"*Ureteral kinks*" may be detected, according to Sampson, as follows: If the end of the ureteral catheter is inserted beyond the kink and sterile fluid is injected through the catheter, distending the ureter and pelvis of the kidney, the patient will complain of pain (artificial renal colic), and on removing the syringe from the end of the catheter (which is left in place), the injected fluid will escape, with relief of pain.

Scratch marks on the catheter tipped with wax caused by a stone in the ureter or pelvis of the kidney may be demonstrated under a lens of a low magnifying power.

DIAGNOSTIC DIETETICS.*

"Such food as is the most grateful, though not so wholesome, is to be preferred to that which is better, though distasteful" (Hippocrates). "More importance is to be attached to the desires and feelings of the patient than to doubtful and fallacious rules of medical art" (Sydenham). "Physicians appear to be too strict and particular in the rules of diet and regimen; too anxious attention to those rules hath often hurt those who were well, and added unnecessarily to the distress of the sick" (Heberden).

Tradition and observation have endowed certain kinds of food with therapeutic attributes, viz.:

Stomachics.—Herring, sardines, caviar, pickles, salads, and the condiments; cooking develops aromatic products.

Antifermentatives.—Alcohol, spices, and carbonated waters.

Laxatives.—Buckwheat and rye bread, fruits, succulent vegetables, and vegetables rich in cellulose which leave a bulky residue.

Intestinal Astringents.—Albumin, chocolate, cocoa, tea, mutton, blackberry brandy, and claret.

Stimulants.—Hot coffee, tea, and alcohol, bouillon and meat extracts.

Hypnotics.—A glass of warm milk, beer, lettuce, and poppy seed before retiring.

Sedatives.—Celery and warm drinks.

Antipyretics.—Acid or effervescent beverages.

Diuretics.—Milk, radishes, asparagus, onions, sugar, and grapes. A vegetable diet reduces and a meat diet augments urinary acidity.

Lactagogues.—Porter, beer, fennel tea, and soups.

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* For further reference to this subject consult Food in the Etiology of Disease (Chapter II), the chapter on the Diagnosis of Visceral Sufficiency (Test-diet in Intestinal Diseases), and the Stomach-tube in Diagnosis (this chapter).

Expectorants.—Carbonated waters, garlic, and sweet warm drinks.

Styptic.—Gelatin.

Alterative.—Cod-liver oil.

Cholagogue.—Olive oil.

Aphrodisiacs.—Celery, radishes, garlic, eggs, and wine.

Anthelmintic.—Pumpkin seeds.

Antacid.—Oil.

Diabetes Mellitus.—One must not conclude because sugar is found in the urine that the patient has true diabetes. First of all, we must assure ourselves that the sugar found is really grape-sugar. For example, at the end of pregnancy and during lactation, if glycosuria exists, it is usually due to the presence of milk-sugar (lactosuria). *Milk-sugar* reduces alkaline copper solutions in boiling, but, unlike grape-sugar, it does not ferment, nor does it show the Rubner reaction for grape-sugar, which is reliable and delicate: 10 cubic centimeters of a concentrated solution of neutral lead acetate (1 of lead to 10 parts of distilled water) are added to 10 c.c. of urine. Filter and add ammonia drop by drop to filtrate until a cheesy precipitate remains. Then heat mixture over a water-bath to 80° C. If dextrose (glucose) is present, the precipitate assumes a beautiful rose or salmon-red color. One must not rely on one but on many tests for sugar. Glycuronic acid, for instance, will reduce alkaline copper solutions, but it does not ferment. Care must be taken not to confound *pentosuria* with diabetes. Pentosuria is not an uncommon affection and is unaffected by diet. Pentoses may react to the usual tests for sugar. Bial's reagent[338] is a simple reaction: 4 c.c. of the fluid are heated to boiling-point in a test-tube, then withdrawn from the flame, and a few drops of the urine to be examined are added. If pentoses are present in quantity sufficient to reduce Fehling's solution, a beautiful green color develops in the fluid within a few seconds, and this reaction is absolutely characteristic. Further, the diagnosis of pentosuria by this means excludes diabetes mellitus, since the two conditions have not been found together. Bial quotes a number of authors who vouch for the reliability of the test. The reagent consists of 0.5 gram orcin dissolved in 500 c.c. of 30 per cent. hydrochloric acid, to the solution being added 20 drops of liq. ferri sesquichlorati. It remains active for at least a year. The source of pentoses occurring in quantity in the urine is not yet definitely established. Bial believes they are not derived from the food, and that there is no renal lesion associated with pentosuria. So far as the evidence goes, it would seem that they are derived from the central nervous system, in which they occur normally.

In true diabetes sugar-excretion is not a temporary affair, but permanent, and persists for weeks and months, and after the ingestion of moderate amounts of carbohydrates an excretion of sugar takes place. Naunyn's test for ascertaining the assimilation limit for carbohydrates is as follows: two hours after a breakfast consisting of a roll and butter with coffee, 100 grams of glucose given in solution ought not to cause a glycosuria. If glycosuria ensues, the individual shows a diminished capacity for warehousing carbohydrates, and true diabetes may eventually follow. Some forms of diabetes are essentially alimentary, dependent on the ingestion of an excessive quantity of carbohydrates, and when the latter are inhibited, the glycosuria ceases. In these alimentary forms the sugar appears in the urine for a few hours only after a repast rich in carbohydrates, hence one should never rely on the primary examination, but base the conclusion on the examination of the first urine passed in the day.

In suspected cases of diabetes pure glucose may be given for the dietetic test. This consists of giving 100 grams (3½ oz.) of the latter and examining the urine three or four hours later. The healthy organism is capable of assimilating this quantity of glucose; hence, if notable quantities are found in the urine, a pathologic condition is present.

Ingestion of 100 grams of levulose only rarely produces levulosuria in healthy individuals, and when the latter is induced, it suggests the existence of a diffuse hepatic affection, most probably advanced cirrhosis. Levulosuria is seldom noted with icterus nor with parenchymatous lesions or metastatic cancer in the liver (Halasz). Hofbauer attributes the toxicoses of pregnancy (eclampsia, vomiting) to the liver. In such cases, if glycosuria occurs after the ingestion of 60 grams of levulose, expectant treatment should cease and pregnancy should be interrupted. Levulose reduces the salts of copper, although more freely than grape-sugar. Levulose may be demonstrated by Seliwanow's reaction; mix the suspected urine with an equal volume of fuming hydrochloric acid and a small quantity of a solution of resorcin (0.5 resorcin, 30 water, 30 strong hydrochloric acid). The mixture is then cautiously heated, and if an eosin or Bordeaux color appears, the presence of levulose may be assumed.

Lorand, believing that the children of diabetics were especially predisposed, and acting on this theory, fed to ten healthy persons (descendants of diabetics) a test-meal consisting of 250 grams of carbohydrates. A distinct sugar-reaction was noted in the urine of eight of these persons twenty-four hours later. Diabetics manifest a tolerance for some carbohydrate foods and an intolerance for others. Thus, the glycosuric may tolerate potatoes or oatmeal better than bread or macaroni. The foregoing is especially demonstrable in dietetic diabetes or glycosuria.

In diabetes (mild cases) the urine should be examined a few hours after an abundant carbohydrate meal and not selected from the whole twenty-four hours' specimen. The maximum excretion of sugar is in the forenoon, even though carbohydrates are consumed during the entire day. It has been found that worry, fright, in fact any mental strain, will increase the excretion of sugar.

It is usual to recognize two forms of diabetes: (1) The mild form, in which the glycosuria and all other symptoms associated with it disappear after carbohydrates are withdrawn from the diet; and (2) a severe form, in which the glycosuria persists even though the patient is restricted to an exclusively animal régime. In this form the sugar excretion may diminish, but does not disappear. Naturally, no case of diabetes is mild, and the distinction made is, in a relative sense, purely arbitrary, for the mild may pass into the severe form. In the mild form of the disease, with regulations of diet and habits the prognosis is usually good, whereas in the severe form the prognosis is bad, for the patients, despite all efforts, soon succumb to their malady. Such subjects are, as a rule, young persons below forty years of age.

Osler suggests the following non-carbohydrate diet:

Breakfast, 7.30 A. M.: 200 c.c. (℥vj) of tea or coffee; 150 grams (℥iv) of beefsteak, mutton-chops without bone, or boiled ham; one or two eggs.

Lunch, 12.30 P. M.: 200 grams (℥vj) cold roast beef; 60 grams (℥ij) celery, fresh cucumbers, or tomatoes with vinegar, olive oil, pepper and salt to taste; 20 c.c. (℥v) whisky with 400 c.c. (℥xiij) water; 60 c.c. (℥ij) coffee, without milk or sugar.

Dinner, 6 P. M.: 200 c.c. clear bouillon; 250 grams (℥viiss) roast beef; 10 grams (℥iiss) butter; 80 grams (℥ij) green salad, with 10 grams (ʒiiss) vinegar and 20 grams (ʒv) olive oil, or three tablespoonfuls of some well-cooked green vegetable; three sardines *à l'huile;* 20 c.c. (ʒv) whisky, with 400 c.c. (℥xiij) water.

Supper, 9 P. M.: two eggs (raw or cooked); 400 c.c. (℥xiij) water.

This diet contains approximately 200 grams of albumin and 135 grams of fat. After this diet the sugar disappears from the urine within four days. According to von Noorden, a non-carbohydrate diet such as given enables the system in a short time to store even considerable quantities of carbohydrates without sugar appearing in the urine. Hence patients who will submit to such a diet may soon be allowed variable quantities of carbohydrates, but in all instances an examination of the urine for sugar is the only test for acquired tolerance for carbohydrates. Naunyn claims that despite a strict diet some patients continue to excrete minute quantities of sugar, and he advises a "hunger-day," *i. e.*, to abstain from all food for twenty-four hours, when aglycosuria occurs, and the power of assimilating carbohydrates is increased. To assist in the latter function, he advises patients to resume an absolute non-carbohydrate diet at intervals of three months.

Another method of testing the grades of diabetes and the tolerance for carbohydrates is that suggested by Ortner. A test-diet consisting of meat (free from carbohydrates or oil) and carefully weighed amounts of green vegetables, such as cabbages or asparagus (never potatoes, beans, peas, or turnips, on account of their great percentage of carbohydrates), milk, and bread or rolls is given for three days, and on the third day the twenty-four-hour urine is gathered and the percentage of sugar determined. By comparing the quantity of carbohydrates ingested with the amount excreted as dextrose in the urine, the amount oxidized by the patient can be determined. The total amount of carbohydrates can be estimated as follows: green vegetables contain 4½ per cent., milk, 4 per cent., and bread, 60 per cent. (the meat being disregarded). If flour and eggs are used in the preparation of the food, their carbohydrates must be estimated in the total (flour, 70 per cent.; eggs, 0.50 per cent.). Supposing the patient receiving the following articles would ingest in round numbers,

130 grams (4½ oz.) of carbohydrates,
300 grams (10 oz.) of meat,
200 grams (7 oz.) of the chosen vegetables,
1½ liters (3 pints) of milk,
2 eggs and 2 rolls.

If the patient on the third day excretes 3 liters (3 quarts) of urine with 1.5 per cent. of sugar, he excretes 45 grams (1½ oz.) of sugar, and would have oxidized 85 grams (3 oz.). His tolerance for carbohydrates would be fairly good. If, however, the urine contained 5 per cent. of sugar, the condition would be more serious, insomuch as 150 grams (5 oz.) of sugar would have been excreted, against 130 grams (4½ oz.) of the carbohydrates ingested.

Mendel and Lusk determined that on a constant proteid-fat diet the constant ratio of glucose to nitrogen was 3.65 : 1, and this fact is employed in prognosis. The patient is put on a meat-fat diet (meat, butter, eggs, and rich cream). On the second day the twenty-four-hour urine is collected (the day ending to include the early morning urine). If N : glucose : : 1 : 3.65, it signifies a complete intolerance for carbohydrates, and probably a rapidly fatal outcome. Stryzowski and Kuhn maintain that the following reaction gives an unfavorable prognosis in diabetes independent of the amount of sugar present: To the urine add 5 per cent. of the formaldehyd of commerce (40 per cent.); at the end of twenty-four to forty-eight hours a fluorescent greenish tint appears.

Etiologic Diagnosis.—It has been remarked by a few observers that a glycosuria which is not influenced by a non-carbohydrate diet is not a true diabetes, excluding, of course, severe forms of diabetes, which are likewise uninfluenced by such a diet. The severe form of diabetes occurs in the so-called thin diabetics who emaciate rapidly and who suffer from pronounced muscular weakness, insatiable hunger, excessive thirst, and polyuria. Alimentary glycosuria may be dependent on some gastric or intestinal anomaly, which, when corrected, has a corresponding influence on the excretion of sugar, and this quite independent of a non-carbohydrate diet. Glycosurias associated with gout are influenced by drugs addressed to the gouty state. Here a non-carbohydrate diet may possibly improve the glycosuria, but would accentuate the symptoms of gout. One must always exercise discretion in the presence of glycosuria. The time was when a cardiac murmur suggested a cardiac affection, and remedies were at once given, for no other reason than that auscultation revealed a murmur. So it is with glycosuria. It is often a question whether interference is justified, especially so if the sugar excreted is below 1 per cent. and constitutional symptoms are absent. Diabetes may be caused by syphilis, and it has often yielded to antisyphilitic treatment alone, without the aid of a special diet. Transitory glycosuria may occur in the secondary stage of syphilis. Hence in diabetics, if a history of syphilis is elicited, the therapeutic test should be tried. Reference is made in the literature to neurogenous glycosuria, and this form is said to be beneficially influenced by sedatives, notably opium. We know that all forms of diabetes are influenced by the nervous system, and that all psychic traumata, like worry, fright, and all emotions, will temporarily augment the excretion of sugar.

Antipyrin is often beneficial in influencing glycosuria dependent on functional neuroses. Another agent which is regarded as of special value in neurogenous glycosuria is *jambul*. The powdered seeds of the latter are given in doses of 5 to 20 grains in capsules. Even larger doses may be necessary.

Before subjecting the patient to a rigid diet the Gerhardt test for diacetic acid must be made, viz., the addition of perchlorid of iron to the urine produces a claret coloration, and if this sign is persistently present, it indicates the most severe form of diabetes (antipyrin, aspirin, and salicylates give a similar reaction). The severe cases of diabetes showing this reaction must not be put on a rigid diet, for there is reason to believe that such a diet may precipitate diabetic coma.* The *oatmeal treatment*, in which oatmeal is given in the form of soup, seems to reduce the diacetic acid in the urine, hence it is available in the severe forms of diabetes or for the purpose of increasing the tolerance for carbohydrates. Von Noorden uses either Knorr's oatmeal or Hohenlohe's oatmeal flakes. This substance is boiled in water for a long time with a little salt; while boiling, butter and a vegetable albuminoid, or, after cooling, the beaten whites of eggs, are added. Roborants may be employed for this purpose with good advantage. The daily quantity is 250 grams of oatmeal, 100 grams of albumin, and 300 grams of butter. The soup prepared in this manner is given every two hours. Cognac or wine or black coffee may also be permitted.

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* Carbohydrate metabolism is determined by placing patient on pure proteid food: if glycosuria disappears, then add starchy foods to diet until glycosuria reappears, and when the sugar exceeds 2 per cent. no more carbohydrates are allowed (Tyson).

Potatoes are often more easily tolerated than bread.

Bread Substitutes.—When it is necessary to prescribe a rigid diet free from starch and sugar, the greatest difficulty is to find a substitute for bread. Many of the diabetic breads contain starch in large quantities (white bread contains about 49 per cent.), and must therefore be excluded. Such bread substitutes may be tested for starch by an aqueous solution of iodin and potassium iodid (iodin, 1; potass. iodid, 1; and water, 100 parts). A drop of this solution gives a deep blue-black color with the starch contained in ordinary white bread, and the depth of coloration may be employed as a basis for comparison in testing the diabetic bread substitutes.

The following directions for the preparation of bread substitutes are given by Williamson:[300]

Cocoanut Cakes: 1 oz. of German yeast, 4 tablespoonfuls of lukewarm water, 16 oz. of desiccated cocoanut powder. Mix into a paste, adding a little more lukewarm water, if necessary. Leave in a warm place for twenty minutes. Then add 2 eggs (beaten up in 3 or 4 tablespoonfuls of milk), and a little salt. Mix well. Place into 16 small dishes or tins (well greased). Bake in a moderate oven twenty or thirty minutes.

(Almond cakes may be made in a similar manner, using almond flour in place of cocoanut powder.)

Protene and almond bread: Mix ½ oz. of German yeast with 2 tablespoonfuls of lukewarm water and 1 oz. of almond flour (ground almonds). Allow the mixture to stand in a warm place for ten minutes, then add 4 oz. of No. 2 protene, 1 egg (beaten up), a little salt, 1½ oz. of butter, and a little milk. Mix all well together with a fork, divide into cobs, or place into small tins, and bake.

Diseases of the Digestive System.—In the discussion of food in the etiology of disease (Chapter II) attention was directed to the importance of a non-carbohydrate diet in the treatment of *dyspepsia* and the importance of rest. Very often a diagnosis is dietetically established by exclusion. We cannot hope to attain results in dyspepsia if thorough mastication is prevented either from negligence or a defective dental apparatus. All patients who consult me for a digestive disturbance are requested to write a complete history of their symptoms, quality and quantity of food ingested, and the time consumed in eating. In this way one obtains very valuable data which would otherwise escape consideration. When the dyspepsia (gastric or intestinal) is severe, an exclusive milk diet for several weeks is often curative. The daily amount of milk necessary must never be less than three pints, and as much as a gallon. The quantity may be reduced by the addition of cream (*vide* milk diet). The milk should be drunk slowly, and its digestibility may be increased by adding a pinch of salt or a teaspoonful of lime-water to each glass. Some prefer taking the milk diluted with water or seltzer. When whole milk is loathsome, it may be skimmed or substituted by buttermilk or koumyss. If the patient will not submit to an exclusively milk diet, then I place the patient on the following diet, which excludes starchy foods:

On waking, 8 oz. of equal parts of hot milk and seltzer water, taken slowly.

Breakfast: Steak or loin chops with fat, soft-boiled or poached egg, half a pint of milk, and a small cup of coffee.

Lunch (10 A. M.): small teacup of squeezed beef-juice.

Midday meal: fish, chicken, scraped meat-ball, baked apples and cream, and two glasses of milk.

Lunch (4 P. M.): Bottle of koumyss, raw scraped beef, or goblet of milk.

5.30 P. M.: Meat or fresh soup, roast or mutton, game, fresh vegetables (except potatoes).

Eat slowly, chew the food thoroughly, and never eat when excited or exhausted.

Patients who will submit to the milk diet are allowed later the diet just given. If patients will not submit to the milk or non-carbohydrate diet, then the physician must select from a list of easily digested articles, and the following table of Penzoldt, arranged after careful observation, will aid him in such selection.

The following articles leave the stomach in:

From 1 *to* 2 *hours:*	100 to 200 grams.....	Water. Tea. Coffee. Cocoa. Beer. Wine. Milk. Bouillon. Soft-boiled eggs.
From 2 *to* 3 *hours:*	200 to 500 grams.....	Coffee with cream. Cocoa with milk. Beef-sausage. Calf's brain. Carp. Pike. Shellfish.
	150 grams ...	Cauliflower. Asparagus. Potatoes (purée). Cherries (compote).
	70 grams....	White bread.
From 3 to 4 *hours:*	200 to 250 grams.....	Chicken (broiled). Partridge (roasted). Pigeon (broiled). Beef (boiled). Ham.
	100 to 150 grams.....	Veal (roasted). Beefsteak. Black bread. Potatoes (mashed). Rice. Spinach. Cucumber salad. Radishes. Apples.
From 4 *to* 5 *hours:*	200 to 250 grams.....	Pigeon (roasted). Beef (fillet). Beefsteak (roasted). Hare (roasted). Goose (roasted). Duck (roasted). Lentils, purée of. Peas, purée of.

In cases where the fermentation of carbohydrates is the cause of dyspepsia the *Salisbury diet* is effectual: the ingestion of raw meat (finely minced and lightly grilled), up to a pound at a time, with nothing else except hot water as a beverage before or after the meal.

Mono-diet.—In the treatment of the sick, it is customary to prescribe a polydiet and, in the event digestive disturbances continue, it is difficult to determine the particular kind of food which is the offending agent. To obviate this objection, Spivak employs what he calls a mono-diet, *i. e.*, the patient is first placed on milk alone for several days which may be changed to meat for the same time, and later, by an exclusive diet of rice or bread. After this manner, eggs, oatmeal, and especially coffee can be excluded as factors in the dyspeptic condition.

Partial Rest-cure.—Practically all dyspepsias are nervous, and unless rest is combined with diet, in many cases, no results are achieved. Intractable cases require an absolute rest-cure. The following is a general plan for a partial rest-cure, and combines rest with forced feeding. On waking in the morning a cup of cocoa is taken, and the patient should remain in bed twenty minutes longer; after this the patient rises and takes a cool or sponge bath, after which the skin is vigorously rubbed with a rough towel; following the bath, breakfast is taken, after which the patient should lie down for an hour and remain at absolute rest without reading. At 10.30 a glass of milk is taken, when the patient may attend to his customary affairs. At 1 o'clock luncheon or dinner is taken, after which meal the patient should lie down for an hour. In the afternoon any recreation may be taken, or attention paid to business until 6.30, when dinner or supper is taken, followed by rest for an hour. At 9.30 the patient should retire for the night.

This partial rest-cure is available in other conditions dependent on an enervated nervous system. In this and the complete rest-cure I find that the use of sugar, according to Toulouse, will cause a decided increase in weight; it acts as a saver of albuminous material and may be given in milk or as a syrup mixed with water. It does not cause digestive disturbances, as a rule. The same object may be achieved by having the patient take lemonade (which necessitates the use of large quantities of sugar) as often as possible.

Gastric Ulcer.—In every dyspepsia which fails to yield to persistent treatment gastric ulcer should be suspected, especially if the patient is of the female sex and chlorotic. That an ulcer may pursue a latent course is evident from the fact that the first symptom may be a perforation, and again it may only be discovered accidentally at the autopsy. In the presence of gastralgic attacks and hematemesis one would not hesitate to diagnose the presence of an ulcer, but unfortunately in a number of instances dyspeptic symptoms alone are present, and our only guide in diagnosis is the success resulting from methods directed against the cure of the ulcer. The test of Chvostek, confirmed by Boas, to differentiate a duodenal from a gastric ulcer is based on the observation that gastric pains coming on two and one-half hours after breakfast are permanently and similar pains about three hours after dinner are temporarily relieved by taking wine. Boas believes that the relief is due to dilution of the superabundant hydrochloric acid by wine and that milk or egg albumin having a stronger tendency to combine with hydrochloric acid should act better than wine. In a series of four hundred and ninety-three cases reported by von Leube, 74 per cent. were cured by medical means, 21 per cent. were improved, 24 per cent. died, and 2.6 per cent. were unimproved. Of the 21 per cent. reported as improved, pain and discomfort recurred as soon as work and the ordinary diet were resumed. When an ulcer fails to yield to medical treatment, our duty is to transfer the patient to the surgeon, who achieves more certain results. The Mayos claim an operative mortality of about 2 per cent.

Hemorrhage is present in about one-half of all cases of ulcer. It may be recognized in the vomitus or by the tarry condition of the feces. Since the inauguration of a simple method for determining latent (occult) hemorrhages the diagnosis of ulcer has been more frequently made, and the test in question enables us to differentiate ulcer from other affections of the stomach. It also permits us to say whether the ulcer has healed as the result of treatment, for, as before mentioned, no symptoms may be present. A test for invisible hemorrhage is of great importance in distinguishing neuroses and other benign affections of the stomach and bowel from latent cases of cancer and ulcer.

Test for Occult Blood.—In a mortar rub up 10 c.c. of liquid feces, or, if the latter are formed, one-half that quantity, with 2 c.c. of glacial acetic acid; add 15 c.c. of ether and transfer to a test-tube. Insert a cork in the latter and mix for five minutes by gently turning the tube up and down. Violent shaking produces an emulsion and makes decantation of the ether difficult. After separation of the ether decant, and to the ethereal solution add 10 drops of tincture of guaiac. The latter is freshly prepared by shaking a few granules of guaiac in half a test-tube of alcohol and adding 30 drops of hydrogen peroxid. A blue color indicates the presence of blood.

The test is exceedingly delicate. Blood entering the gastro-intestinal tract from the mouth, nose, or throat, or after the irritation of the stomach-tube, may lead to a false conclusion. One must likewise exclude, for at least three days before the test is made, certain articles of food containing blood, viz., fish and meat or their extracts. The foregoing test will give a positive reaction with approximately 1 part of blood in 10,000.

Another delicate reaction is the *benzidin test*, but owing to its excessive sensitiveness, it was not regarded as available for testing feces. Schlesinger and Holst,[311] however, have recommended a method which makes it suitable for routine use. The patient must abstain from meat for four days, and from the mixed stool of a single evacuation a portion the size of a pea is shaken up with a small quantity of water in a test-tube and the mixture boiled for a few minutes. A few drops of this fluid are added to the reagent in another test-tube, and, if blood is present, a green or blue color, depending on the amount of blood, will appear. The reagent consists of a freshly prepared, saturated alcoholic solution of benzidin acidulated with glacial acetic acid. To ½ c.c. of this, 2 to 3 c.c. of 3 per cent. peroxid of hydrogen solution are added. That the test performed in this way is not misleadingly delicate is shown by the fact that in a series of one hundred and fifty stools from patients supposed to have gastro-intestinal ulceration or carcinoma, negative results were obtained in about one-third of the tests. The authors also recommend it highly for the purpose of detecting minimal amounts of blood in urine, and suggest the following mode of procedure. To 10 c.c. of urine in a test-tube ½ to 1 c.c. of acetic acid is added, and, after shaking, one-third of the volume of sulphuric ether is added. The whole is well shaken, and the ether extract is caused to separate completely by dropping in 5 or 10 drops of absolute alcohol. This clear ether extract is then tested with the benzidin reagent in the manner indicated above. It was found that, performed in this way, the benzidin test was twenty times as delicate as Heller's test, and five times as delicate as the guaiac and aloin tests.

There are many dietetic methods of treating gastric ulcer, and, emanating from authoritative sources, they are unquestionably of value, but my experience justifies me in the conclusion that the withdrawal of all food by the mouth and feeding by the rectum is the method which has given me good results, and I therefore employ it to the exclusion of all other methods.

Diet in Gastric Ulcer.—The Lenhartz treatment is a recognized method in Germany, and excellent results are achieved. Lenhartz bases his treatment on the supposition that the chief cause of ulcer is hyperchlorhydria, and that egg-albumin is the most efficient food that will bind hydrochloric acid and thus neutralize hyperacidity. One knows that a rich albuminous diet is very efficient in gastric disorders in nervous and chlorotic subjects. The albumin binding the acid in such subjects is very efficacious in inhibiting the sour regurgitation, epigastric distress, and pain and pressure after eating. Haberman[98] gives the following tabulated management at the Eppendorfer Krankenhaus:

Absolute rest in bed for at least four weeks. All mental excitement to be avoided. An ice-bag is placed upon the stomach, and kept there almost continuously for two weeks. This prevents gaseous distention, prompts contraction of the stomach-walls, thus tending to obviate hemorrhage, and eases the pain when present. On the first day, even where a hematemesis has occurred, the patient receives between 200 and 300 c.c. of iced milk, given in spoonfuls, and two to four beaten eggs. At the same time bismuth subnitrate is given twice or thrice a day, 2 gm. at a dose, and is continued for ten days. The eggs are beaten up entire (with a little sugar) and the cup containing them is placed in a dish filled with ice, so that they remain cold. Sometimes a little wine is added. This food at once "binds" the supersecreted acid, and therefore mitigates the pain rapidly and causes the vomiting, often quite troublesome, to cease. The allowance of milk is increased 100 c.c. daily, and at the same time one additional egg is given, so that at the end of the first week the patient is receiving 800 c.c. of milk and six to eight eggs. Both these foods are now continued in the same amount per day for another week. No more than one liter of milk a day is allowed at any time.

Besides milk and eggs some raw chopped meat is given from the fourth to the eighth day on, usually the sixth; 35 gm. per day, in small divided doses (easily stirred up with the eggs or given alone), the day after 70 gm., and later possibly more, if well digested. The patient is now able to take some rice or "Griesbrei," well cooked, and a little zwieback (softened). In the third week quite a mixed diet is tolerated, the meat being now given well cooked or lightly broiled. All heavy foods are, of course, interdicted, as well as vegetables with husks, etc., and those tending to produce flatulence. At the same time the patient is given strict orders to masticate his food thoroughly. Under this treatment the symptoms are said to disappear in a few days and an increase in the body-weight is manifest during the first week. The bowels are let alone until after the second week, when glycerin injections or warm water is used.

Retention of Food in the Stomach.—Nyrop[822] refers to the importance of retention for diagnosis and differentiation. Retention may be the result of a malignant or harmless affection, and it may be of functional or organic origin, and in the latter case may be the result of some obstacle to the evacuation of the stomach or to weakness of the stomach musculature. But, whatever the cause, it indicates operative treatment. He pleads for tests for retention in every stomach and intestinal affection, from the mildest to the severest, without exception, as also in all abdominal affections accompanied by gastric symptoms. The test recommended is the Bourget test-meal, consisting of eight or ten stewed prunes, meat, and bread. Nothing is eaten after this meal, taken at 7 P. M., and the next morning, about 7 A. M., the contents of the stomach are withdrawn and the stomach is rinsed out. The findings in two hundred and two cases are tabulated, with the diagnosis and course. The results show that the discovery of remains of meat and prunes in the stomach, twelve hours after their ingestion, is always a sign of some notable disturbance in the functioning of the stomach, and that this discovery indicates laparotomy. In seventy-five of the two hundred and two patients examined the rinsing fluid was always free from remains of the test-meal, and although there were marked evidences of a gastric affection in these cases, yet the absence of retention showed the spasmodic character of the trouble, and its subsidence during sleep, or else that the stomach was able to overcome the obstacle during repose. In some cases it is better to make the test in the morning, giving the test-meal at 8 A. M. and examining the stomach contents at 8 P. M. He expatiates on the terrible responsibility of the general practitioner who wastes time on internal measures while waiting for a palpable tumor. Many cases are cited, from personal experience and the literature, as examples proving the necessity for the rule: "Retention, no matter how slight, twelve hours after a Bourget test-meal, is always an indication for laparotomy." It is comparatively immaterial, he asserts, whether the underlying trouble is malignant or not.

The Ingestion of Food in Diagnosis.—If pain is felt during the ingestion of food, a deep-seated esophageal stenosis may be suspected. In gastro-intestinal diseases food induces pain from the following causes: 1. By increasing peristalsis (notably cold drinks). 2. By the formation of gas (after farinaceous food). If, for example, in intestinal disease, pain immediately follows the ingestion of food, it is caused by intestinal peristalsis. Thus gastric meteorism, by augmenting the tension of the walls of the stomach, will actuate the pains of gastric ulcer. In the latter affection food rich in condiments will aggravate the pains, whereas meat may often relieve the pain, owing to its combination with the excess of hydrochloric acid present in the stomach. In gastric neuroses (when there is an excess of hydrochloric acid), a glass of milk or a piece of meat, which likewise combines with the acid after the manner of an alkali, will also relieve the pain. In ulceration of the esophagus, acids or food rich in condiments will cause pain during deglutition. The sensation of hunger (growling of the stomach) is often caused by augmented peristalsis of the organ, which is subdued by the ingestion of food. In pyloric lesions pains occur, as a rule, about two or three hours after the chief meal (expulsive period of digestion) and relief is obtained by vomiting or eructations of gas. The colic of the latter affection may be confounded with biliary colic, but here the nature of the food has a very slight effect on the pains, while vomiting does not relieve and may, in fact, increase the pain. It is not a question of the quality but the quantity of food which may initiate an attack of biliary colic. In affections of the heart, notably angina, meals of farinaceous food actuate the pains, owing to the formation of gas, which inflates the stomach and intestine. In gastric cancer, meat, solid food, and vegetables are distasteful and, unlike the neuroses of the stomach, such food provokes pain.

Rectal Feeding.—Complete physical rest with rectal feeding is the method for treating gastric ulcer first successfully employed by von Leube. I do not allow patients to take even water, and, as a rule, the patients suffer no discomfort. Before each nutrient enema a cleansing injection of salt and water is used. The following nutrient enema of Ewald is employed three or four times a day: Two or three eggs are beaten up with a tablespoonful of cold water. Have in readiness a 20 per cent. solution of glucose boiled with a pinch of the best flour and add a wineglassful of claret. When this solution has cooled enough not to coagulate the eggs, the two are gradually stirred together. The mixture should not make more than half a pint. This enema is introduced high up into the rectum by means of a soft-rubber tube. The patient must lie either in the dorsal or left lateral posture during the time the enema is introduced. The enema must be introduced slowly. If the rectum becomes irritable, a few drops of opium tincture may be used, or a little starch is added to the enema to make it more viscid. The von Leube enema may also be used. Riegel reports a case of esophageal stricture where the patient was kept alive for ten months by the exclusive use of the von Leube enema. It is made as follows: Chopped beef, 150 to 300 grams; finely chopped and fat-free pancreas (from hog or cow), 50 to 100 grams.

Exclusive nourishment per rectum in ulcer may be maintained for from two to three weeks. Then careful feeding is commenced with predigested milk, a tablespoonful every hour, and increased daily until at the end of a week 3 or 4 pints are taken daily. During this time rectal feeding may be continued until sufficient nourishment is taken by the mouth.

As a rule, a gastric ulcer heals after exclusive nourishment per rectum, and the symptoms consequently disappear. Thus the diagnosis is established. In a few instances the pain and other symptoms persist. I can recall seven instances of that kind in my private practice. In three patients the pain recurred in from two to six weeks after treatment was discontinued. I attributed the pain to cicatrization of the ulcer, but investigation demonstrated that the ulcer had not completely healed, and another treatment by rectal feeding resulted in cure in all three instances. In two patients the autopsy demonstrated a carcinomatous infiltration of the borders of the ulcer. One patient demonstrated perigastric adhesions at the operation; and another, gastrectasis dependent on cicatricial stenosis of the pylorus. A duodenal ulcer is often amenable to treatment by rectal feeding and physical rest. In some instances it may be necessary if the stomach distress continues during rectal feeding in gastric ulcer to use hypodermatic injections of atropin ($\frac{1}{120}$ to $\frac{1}{60}$ grain) night and morning. This drug advocated by Riegel is of undoubted value in checking hypersecretion and may be used after the same manner in hyperacidity.*

Intestinal Auto-intoxication.—Intestinal putrefaction may be due to the action of germs normally present in the intestines or to foreign germs. Putrefaction invariably results from the decomposition of albuminous food. When intestinal auto-intoxication is suspected and a diagnostic test diet is employed, proteids and foreign germs should be excluded and sterilized buttermilk should be used. Later, if the condition of the patient has improved, milk, bread, puddings, and other starchy foods may be permitted, and, finally, when proteids are allowed, only the digestible and absorbable proteids are given.

An antiputrid régime predicates the exclusion of albuminous food and the substitution of carbohydrates or sugary foods. The latter are well represented by the farinaceous foods (rice, farina of cereals, and their derivatives), because they are less easily absorbed and therefore gradually furnish lactic acid. This acid inhibits the action of the proteolytic bacilli in the large intestine from acting on the albuminous food-stuffs. Winternitz has shown that, if a certain quantity of milk is given with a meat diet, it will diminish the production of enterotoxins. Milk alone is less efficient in an antiputrid régime than when combined with farinaceous food. Among the food-products allowed in the régime under consideration are: Milk, best combined with farinaceous food, cooked vegetables, preferably as purées, preserved or cooked fruits, weak coffee, tea, or cocoa, toast with little butter, fresh cream cheese, buttermilk, and koumyss. In obscure cases of neurasthenia dependent on auto-intoxication, surprising results may often be achieved in a few days by a non-proteid diet. In neurasthenia of auto-intoxication the diagnosis must not be based on dyspeptic symptoms, for, as a rule, they are absent.

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* Rectal feeding may also be used in differentiating gastro-intestinal from other visceral pains (notably gall-stones), insomuch as the latter would be uninfluenced by such feeding.

Lithemia.—This condition is called *uricacidemia*, because it is caused by overeating and overdrinking, the consequence being that the food is not completely oxidized, and there is an accumulation in the blood of partly oxidized products of food metamorphosis of which uric acid is the type. It is also called *American gout*, because it is supposed to occupy in this country the same position that gout does in England, although the joints are not implicated. In a word, it is a disease of deficient oxidation; an excessive ingestion of food, coupled with a lack of exercise making the increment exceed the excrement. The urine is scanty, high colored, high specific gravity, and deposits on standing a bulky sediment composed of urates and uric acid. There are symptoms of indigestion, nervous irritability, headache, and increased arterial tension. When lithemia is suspected, for we are unable to furnish any actual demonstration of its existence, dieting furnishes an index to diagnosis. Lithemic patients show high blood-pressure and they often respond to the following diet of Haig: Roughly speaking, an individual weighing 140 pounds is required to consume 21 ounces of breadstuff a day, supplemented by 7 ounces of dry fruits. To this may be added a small quantity of potato or other vegetable and any fresh fruit in season. The bread may be made as a pudding, using a little milk, but so far as possible fluids should be excluded. The foregoing day's food may be divided into three meals, each containing 7 ounces of bread-stuffs and 2 or 3 ounces of dry fruits. A blood-pressure of about 155 mm. can be reduced in a week or more to 120 mm. One may also employ a uric-acid-free diet (Tables I, II, III, Chapter II).

Nutritional Disturbances.—There are many diseases which are clearly associated with defective nutrition. It is an established fact that different tissues require different food materials, but at present we are unable to determine the metabolism of individual organs, hence we must consider the body as a whole. We know what forced nutrition will do in grave forms of neurasthenia and in phthisis, but there are many other affections which are equally amenable to forced nutrition. Body-weight furnishes the most reliable guide to the state of nutrition and a good layer of subcutaneous fat is of more importance than the condition of the muscles. There are many individuals who suffer from vague pains the nature of which is difficult to elicit. Such pains are particularly accentuated by weather influences. We are inclined to regard them as rheumatic, but the salicylates fail to cure. The majority of the patients are badly nourished, irritable women. I have long considered such pains to be associated with a loss of fat in the medullary sheath of the nerve, and the latter, being thus insufficiently insulated, responds readily to all kinds of stimuli. At any rate, the good results achieved by forced nutrition justify this conclusion. The loss of abdominal fat is responsible for many cases of gastroptosis, hence the value of forced feeding in diagnosis and treatment.

As an aid in diagnosis forced nutrition is best achieved by means of a rest-cure.

Rest-cure.—A rest-cure is an aggregation of cures—a water, diet, exercise, and a mind-cure. The cardinal points of the rest-cure are isolation of the patient, rest with exercise, and overfeeding. The details of the method are essentially as follows: The patient is confined to bed, and under no circumstance is allowed to get up, to read, or to write. The patient is fed by the nurse to secure passivity of mind and body. Absolute rest is not always enforced, the method being modified to suit the individual case. To facilitate digestion and build up nutrition during the rest-cure, massage and electricity are employed daily. The latter furnish exercise to the unused muscles, improve the circulation, and promote the absorption of nourishment. Great discretion must be exercised by the physician in the selection of the proper diet, and when this is accomplished, it is surprising what prodigious quantities of food can be taken. The improvement in nutrition is manifested by increase in weight, which may be, in a rest-cure lasting eight to ten weeks, all the way from 10 to 40 pounds. The food consists of milk, alone or with cream, gradually increased until five or more pints are taken daily in addition to the ordinary meals. An intelligent nurse is indispensable—a poor nurse is worse than useless.

Physiologic rest is important in practically all affections, especially in acute disease. Thus, in wounds, rest prevents the spread of infection, insomuch as motion introduces fresh surfaces to inoculation and breaks down protective barriers of leukocytes (Billroth). Rest in bed diminishes the amount of blood sent to an inflamed part and lessens the force of the circulation; hence it antagonizes stasis (Da Costa). Rest in bed saves the heart at least 21,000 beats a day.

Obesity.—An abnormal accumulation of fat frequently provokes many symptoms, and it is not until a *reduction cure* is executed that we are in a position to determine the relation that obesity bears to the symptoms in question. All obese subjects suffer from shortness of breath, and in numerous instances dyspnea becomes the most prominent symptom. It is due to mediastinal fat preventing lung expansion, interference with the diaphragmatic movements caused by intra-abdominal fat, and an enlarged fatty liver. In addition to these mechanic causes, dyspnea is caused by changes in the heart-muscle. The heart in obesity is always goaded to greater activity by the large quantities of food and stimulants ingested, which increase blood-tension, and by obstruction to the free circulation of blood by the accumulated fat. Again, there is an excess of subpericardial fat, which may encroach on the muscular fibers and destroy them, so that eventually, in pronounced cases, fat may entirely substitute muscle. In atrophic nephritis obesity, by compromising the cardiac muscle, may provoke many symptoms, for, as von Noorden observes, "the fate of these patients is dependent on the functional powers of the heart." In chronic articular rheumatism the reduction of obesity removes pressure and excessive work from the joints and benefits locomotion. Von Noorden recommends reduction cures in certain forms of sciatica and other neuralgias observed in obese subjects. He observes that it is impossible to predict what cases a reduction cure will benefit, but as improvement is usually noted within two or three weeks, this cure should be tried.

I have obtained excellent results in the treatment of obstinate neuralgia in obese subjects by a reduction cure. I have likened such cases to adiposis dolorosa (Dercum's disease) and have noted a moderate anesthesia of the skin over the areas of the affected nerves.

Von Noorden refers to the value of reduction cures in obese hysterical subjects, and notes that after reduction there is a revival of strength and self-confidence. I have in several instances caused the disappearance of paroxysms of bronchial asthma in obese subjects by a reduction cure.

Contraindications.—Generally speaking, a reduction cure is not a starvation process, provided the cure takes into consideration the individual to be treated. Obesity itself is a nutritional disorder, and restrictions of diet in a quantitative and qualitative direction are beneficial, not harmful. In subjects who have been obese all their life, especially in those who are advanced in age, a reduction cure is a serious matter, and should not be attempted. Rapid reduction cures are never indicated, especially those at watering-places like Kissingen, Marienbad, or Homburg, where patients are subjected to a special diet and then allowed to return home to commit anew their dietetic errors. In slow reduction cures the loss of fat is more uniform than in rapid cures. Reduction cures must not be attempted in diseases of the circulatory system until we have assured ourselves that cardiac insufficiency is not present. It is a grave therapeutic error to attempt a reduction cure in an obese subject with a weak heart. It is evident that in an obese subject one must distinguish between fatty degeneration and fatty overgrowth of the heart. In the latter condition the myocardium is not necessarily compromised, whereas in degeneration it always is. Here we must have recourse to the methods for testing the efficiency of the heart (*vide* chapter, Diagnosis of Visceral Sufficiency). The Oertel and Schott treatment are especially indicated in weak heart associated with fatty overgrowth.

Technic of Reduction Cures.—The essential cause of most cases of obesity is in a misproportion between the energy taken in the form of food and the amount expended as heat and work. Anemia is often associated with obesity, and the iron-containing elements of the blood being deficient, there is a corresponding lack of oxygen (anoxemia), which by interfering with oxidation conduces to the accumulation of fat in the body. Iron is usually necessary in the treatment of obesity. Generally speaking, the treatment of obesity is based on two broad principles: (1) supplying less food to oxidize; (2) augmenting the oxidation of fat in the body.

The first principle is accomplished by diminishing the quantity of food and excluding the carbohydrates. Eating frequently during the day and proscribing the so-called "meal" will do much to obviate the tendency of overeating. To augment oxidation, exercises are indicated. A combination of exercise and diet is the ideal method for reducing the weight of the corpulent subject. The best reduction cure aims to spare the albuminoid constituents of the body, so that the fat only will be oxidized. This can be attained if the patient ingests 1 to 1.30 grams of albumin to each kilogram of body-weight. Thus an individual weighing 80 kilograms by ingesting 80 to 104 grams of albumin can maintain the nitrogenous equilibrium.

Reduction cures may be divided into the following grades: (1) Slight reduction with four-fifths of the average quantity of food ingested, so that the caloric value of the food will be 2000 in lieu of 2500 calories. Here restriction is confined to alcohol, potatoes, and foods rich in sugar. (2) Medium reduction with three-fifths of the average quantity of ingested food, thus making the caloric food value 1500 in lieu of 2500 calories. (3) Forced reduction with two-fifths the average quantity of food and a reduction to 1000 calories.

Von Noorden's dietary for obesity is as follows:

8 A. M.: 80 grams of lean, cold meat, 25 grams of bread, one cup of tea with a spoonful of milk, no sugar.

10 A. M.: one egg.

12 M.: a cup of strong meat broth.

1 P. M.: a small plate of meat soup flavored with vegetables, 159 grams of lean meat of one or two sorts, partly fish, partly flesh, 100 grams of potatoes with salad, 100 grams of fresh fruit, or compote with sugar.

3 P. M.: a cup of black coffee.

4 P. M.: 200 grams of fresh fruit.

6 P. M.: 250 grams of milk, if desired, with tea.

8 P. M.: 125 grams of cold meat, or 180 grams of meat weighed raw and grilled, and eaten with pickles or radishes and salad, 30 grams of Graham bread, and two or three spoonfuls of cooked fruit without sugar.

A glass of wine is permitted twice daily, and the use of weak tea, lemonade, or mineral water is not restricted, either at meals or in the intervals. An occasional "*hunger-day*" is given. It is evident that a thorough obesity cure, especially in pronounced cases, cannot be executed without an efficient nurse who weighs and prepares the food given.

The *Karell method*, recommended by Mitchell, in his book, "Fat and Blood," is as follows. It is a rapid and efficient method if employed with circumspection: The patient is put on skimmed milk and other fluids alone. After finding the quantity of milk that will maintain the weight, the amount is reduced gradually until the loss in weight amounts to a half pound a day. This loss may be exceeded or diminished according to the resistance of the patient. Rest in bed or a lounge must be enjoined during the treatment. If any symptom of weakness arises or the loss is too rapid, then, in addition to the milk, a little meat or soup is allowed. Massage daily should be given during the cure.

Oertel Method.—This and the Schott treatment are especially indicated when a weak heart complicates obesity. The method embodies the following: (1) Diet. (2) Restriction of fluids to 36 ounces daily, which includes the amount taken with the food. (3) Graduated exercises up hills of various grades, to systematically exercise and strengthen the heart. The distance climbed each day is marked off and gradually increased. These graduated exercises are the most important part of this method.

The diet is as follows:

Morning: A cup of tea or coffee with a little milk. Bread, 3 ounces. The amount of liquid must not exceed 6 ounces.

Noon: Soup, 3 or 4 ounces; roast veal, beef, game, or poultry, 7 to 8 ounces; salad or vegetable and a little fish; 1 ounce of bread or pudding and 3 to 6 ounces of fruit. No liquids, but if the weather is hot, 6 ounces of light wine may be taken.

Afternoon: Tea or coffee, 6 ounces, and the same quantity of water; 1 ounce of bread if necessary.

Evening: One or two soft-boiled eggs; bread, 1 ounce; cheese, salad, and fruit, if necessary. At this meal 6 or 8 ounces of wine with 4 ounces of water.

The Schweninger method is similar to that of Oertel, and consists of restricting water at meals and less than a pint a day.

Schott Treatment.—*Vide* resistance gymnastics and carbonated baths, in this chapter. I doubt whether this treatment alone is of any real service in obesity unless combined with diet. The object attained by this treatment is to sustain a weak heart during the reduction cure. Digitalis will also be found efficient for this purpose.

Concluding Remarks.—Any prescribed method of conducting a reduction treatment which ignores individual idiosyncrasies is bad, on the principle, "What is one man's meat, is another man's poison." Von Noorden insists on short courses of treatment, lasting about four weeks, and when there is a loss of weight of a few kilos, the patient should be induced to take advantage of comparative leanness and strengthen his muscles by systematic exercises.

In executing an obesity diet patients often suffer severely from hunger, and a feeling of satiety is necessary to the sense of well-being and capacity for work. It is often desirable to contribute to the feeling of repletion without adding anything nourishing. Sternberg suggests the ligamentum nuchæ for this purpose, which is boiled until it becomes perfectly soft and then passed through a chopping machine. One of the recipes recommended by the author is as follows: The chopped ligament, as above, is stirred with whipped cream and put into a buttered ramekin; a raw egg is added and the whole is baked in a dish containing hot water. Before serving, cheese is sprinkled over the top.

In the dietetic treatment of obesity the nitrogen equilibrium must be maintained, and if signs of circulatory failure ensue, with nervous symptoms, an immediate increase of proteids is necessary.

Thorough mastication reduces the tendency to obesity by causing better assimilation of food, and by satisfying the appetite less food is ingested. Oertel regards heredity as a cause of obesity in 50 per cent. of all cases, and Ewart directs attention to physiologic corpulency which ran in families and demanded no treatment and pathologic stoutness due to a relative deficiency in oxidation. Wood divides obese subjects into two classes: (1) The anemic, with deficient muscular power, and (2) the plethoric and robust. In the latter only is a rigid diet indicated.

Salt-free Diet.—It has frequently been observed that there is a diminished elimination of chlorids* in cases of acute and chronic parenchymatous nephritis. It has been demonstrated that the cause of the edema in nephritis is due to the retention of sodium chlorid in the tissues, and that the latter in consequence require a greater amount of water to maintain the salt in solution. Now, if the patient takes much salt with the food, it fails to be eliminated and edema develops. From 15 to 75 grains of sodium chlorid are required daily for the maintenance of health. The treatment of dropsy by dechlorination results in profuse diuresis and diminution of the dropsical effusion. It has been suggested that the beneficial action of milk in nephritis is due to the small proportion of sodium chlorid. Miller and Boyd have shown recently that if large quantities of salt were taken by nephritic patients, there was a rapid increase in weight, due to the accumulation of fluid and an increase in albuminuria.

In interstitial nephritis no edema is produced, even though large doses of sodium chlorid (150 grains) are given (Widal and Javal). The latter authors[96] demonstrated that the hydration of the body runs parallel to the amount of chlorid excretion, and that by changing three men very abruptly from a diet very rich in chlorids to one deficient in the latter, the body-weight could be reduced 2 kilos. The authors in question give meat even in acute nephritis, provided that in cooking a minimum of chlorid is used. The following dietaries contain small quantities of chlorids:

Widal:

(*A*) Potatoes	1000	grams	(*B*) Bread (without salt)	500	grams
Raw meat	400	"	Raw meat	480	"
Sugar	200	"	Sugar	100	"
Butter	20	"	Butter	80	"
Tisane	2500	"	Tisane	2500	"

Achard and Paisseau:

Beef boiled and steeped in vinegar	500	grams
Potatoes with oil and vinegar	500	"
Sweetened rice	50	"
Tisane	2500	"
Sugar	120	"

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* Test for chlorids: Add to urine in a test-tube 10 drops of pure nitric acid and then 1 drop of silver nitrate solution (1 : 10). If the chlorids are normal, a solid ball of silver chlorid settles to the bottom of the tube. Cloudiness, however intense, without a precipitate, indicates a deficiency. If a cloudiness results from the addition of nitric acid alone, it indicates the presence of albumin, and the urine must then be filtered before adding the silver solution.

The former (*A* and *B*) contain about the same quantity of NaCl (1.50 grams) as a liter of milk, whereas the latter contains about 3 grams.

Peabody[251] comments favorably on the salt-free diet, but he suggests that it is almost impossible to administer a diet which is absolutely salt-free. The first thing is to prohibit the patient from using salt with his food, and, secondly, to see that in the cooking of his food salt is not added during that process by the cook. The diet can be almost as liberal as that which is allowed the ordinary healthy individual if this precaution is taken, and the following list may be employed with advantage:

Breakfast: Coffee or tea, eggs, cereals, cream, fresh butter, fruits, bread made without salt.

10 A. M.: A glass of milk.

Dinner: Chicken, fish, potato variously prepared, bread made without salt, ice-cream, jelly, fresh butter, cocoa.

3 P. M.: A glass of milk or water.

Supper: Eggs, chicken, bread without salt, jelly, custard, cream, fresh butter, tea.

8 P. M.: A glass of milk or water.

After the anasarca has diminished to such an extent that it is no longer manifest, it is not proper to maintain the absolutely salt-free diet. Small quantities of salt may be allowed until evidences of edema are once more developed, when the salt should be once more stricken from the diet list. It is well to remember that one of the best ways of determining that a patient is rapidly losing an excess of fluid is not alone to measure the quantity of urine passed, which often depends to a large extent upon the amount ingested, but to weigh him, any marked loss in weight being an excellent criterion of the quantity of fluid which is being lost from the tissues.

Dehydration of the tissues by dechlorination has also been employed in obesity and cardiac disease. Widal more recently refers to the details of the appropriate diet. Bread can be made by the baker without salt. Meat contains, on an average, 1 gram of NaCl per kilo, and is one of the foods that can be ingested most easily without salt. Only the fresh-water varieties of fish are allowed. The flesh of salt-water fish contains in some instances 4 grams of NaCl per kilo. Fresh eggs may be ingested without salt;

fresh butter and cream and saltless cheese may be permitted. Potatoes and most vegetables may be taken without salt. Bouillon must be excluded, as it is a regular salt-solution. A chlorin-free diet is often efficient in edema and dropsy of various origin. The absorption of many exudates may be hastened by the same diet.

In *diabetes insipidus* the kidneys are unable to produce a urine of normal concentration. In the norm the concentration of the urine responds to a change in the diet, but this is not the case with the polyuric. The inability to produce a concentrated urine is also present in interstitial nephritis and pyelitis, but in diabetes insipidus the concentration of the urine is more constant.

Salt-hunger.—In executing dechlorination treatment one must not forget the effects of salt-hunger. If salt is completely excluded in the diet, free hydrochloric acid disappears from the gastric juice, and digestion thus impaired causes emaciation, muscular weakness, tremors, occasional convulsions, dulled mental faculties, and the presence of *acetone* in the urine and breath. In man an abstinence of nine days is serious, but not necessarily dangerous, and it may be fully two weeks before a normal condition is attained.

Attention is called to the symptoms of salt-hunger to prevent the physician from carrying dechlorination to extremes.

Tufnell Diet.—In suspected aneurisms the diet recommended by Tufnell, of Dublin, will often lead to an amelioration of symptoms. In connection with the Spartan régime, absolute rest in bed is imperative in order to reduce the number of heart-beats. The treatment must be pursued for several months, although few patients can tolerate the treatment for more than a few weeks at a time. The diet is as follows: 2 oz. of bread and butter and 2 oz. of milk for breakfast; 2 or 3 oz. of bread and 2 or 3 oz. of meat for dinner, with 2 to 4 oz. of milk or claret; and 2 oz. of bread and butter with 2 oz. of milk for supper. Potassium iodid is a valuable addition to the treatment.

Epilepsy.—There is some reason to believe that the augmented toxicity of the urine and blood in this disease suggests a toxic origin for the paroxysmal attacks of epilepsy, periodic headache, and migraine. A diet rich in meat will increase the number of epileptic seizures, whereas a farinaceous diet is followed by a decrease in the number of the attacks. Various diets have been tried, but not with uniform results. One of the latest methods is that known as salt starvation, in which the bromid preparations substitute the salts of chlorin. The dietary suggested by Balint was made up as follows: Milk, fresh butter, eggs without salt, vegetables, fruit, household bread, weak tea, coffee, and cocoa without sugar. This diet excludes meat and diminishes the amount of salt.. Excellent results have been achieved by Turner[287] with a purin-free diet and 20 to 30 grains of sodium bromid at bedtime. A purin-free diet is of great therapeutic value, but it also serves as a test whether the symptoms of the disease are toxic or non-toxic.

There are two forms of purin body—the exogenous, derived from the ingestion of food, and the endogenous, from tissue metabolism. For practical purposes, however, the former is of the greater importance. Purin bodies exist in all forms of meat extracts, in both the white and the red meats commonly used as food, and in large quantities in certain glands, viz., the thymus and the pancreas. They are also present to a less extent in some vegetables, and are markedly present in tea and coffee.

A purin-free diet may be obtained from the following common articles of food: Milk, eggs, butter, cheese, rice, macaroni, tapioca, white bread, cabbage, lettuce, cauliflower, sugar, and fruit.

Of food-stuffs containing small quantities of purin bodies the following may be mentioned: Peameal, malted lentils, potatoes, and onions. In the last two the quantity is so small as to be almost negligible.

Common articles of diet which should be avoided in this connection are: Tea, cocoa, and coffee, and all kinds of fish, fowl, and meat (including sweetbread). Of the meaty foods which contain only relatively small quantities of purin bodies, and which might be added to the dietary, if not rigidly enforced, may be mentioned tripe, neck of pork, and codfish.

Skin Diseases.—Crocker makes the very pertinent observation that whatever irritates the gastric mucous membrane aggravates the skin trouble. Malcolm Morris,[288] in commenting on the discussion on the treatment of skin diseases by diet which took place at the meeting of the British Medical Association in 1895, quotes the words of Byron:

> "All that we know is nothing can be known."

Idiosyncrasy may cause and aggravate skin diseases. Thus, shellfish and certain fruits and vegetables cause eruptions in susceptible persons. Brocq considers that the white of egg will cause urticaria. Alcohol causes the face to flush. In eczema the patients eat too much or too well, and by diminishing the amount of ingested food, much benefit is derived in this and in other skin diseases. Morris cautions us not to put our faith in printed dietaries, or indeed in any general formularies. Above all, to remember that the patient has larger and better opportunities of observation than the doctor, and, if he is a person of ordinary intelligence and self-control, he should be trusted. The doctor who attempts to dictate as an oracle in the matter of diet is like Lord Foppington's bootmaker, who insisted that he knew better than his client whether or not the shoe pinched.

DIAGNOSTIC ELECTRO-THERAPEUTICS.

ABBREVIATIONS EMPLOYED IN AN ELECTRICAL EXAMINATION.

Faradic Current.

X mm. D = Distance in millimeters that the secondary has been withdrawn from the primary coil.
Far. C. 90 mm. D. = a minimal faradic contraction will be excited when the secondary coil is withdrawn 90 millimeters.

Galvanic Current.

M.A. = Milliampères.
V. = Volt.
Ca. C.C. = Cathodal closing contraction.
An. C.C. = Anodal closing contraction.
An. O.C. = Anodal opening contraction.
Ca. O.C. = Cathodal opening contraction.
Ca. C.T. = Cathodal closure tetanus.
Ca. C.C. = 2 M.A. = the minimal current necessary (2 M.A.) to produce muscular contraction by closure of the cathode.
Ca. C.C. > An. C.C. = cathodal closure contraction is greater than the anodal closure contraction.

Electro-diagnosis.—One of the primary steps in an electrical examination is to test the electric irritability of nerves and muscles. For this purpose we limit ourselves to a faradic (interrupted) and a galvanic (constant) apparatus. Either current may be run by dry or wet cells or by the street current. A rheostat is used for regulating the strength, a milliampèremeter for measuring the strength, and a switch for changing the direction of the galvanic current. Two electrodes are necessary: a large or indifferent one, 2 by 6 inches in diameter, and a small or selective one, 1¼ inches in diameter. The latter must be furnished with a button which opens or closes the current while the electrode is stationary.

Electrical stimulation is effected by the following polar method: Both electrodes are well moistened. The large electrode is placed at an indifferent point—sternum or between the scapulæ. The sternum is preferable because the electrode can be held by the patient, although the skin in this situation is more sensitive. The small electrode is placed on any one of the motor points to be tested. This electrode is also called an exciting electrode, because its small surface permits the greatest possible current concentration. The motor points (Figs. 48, 49, 50, 51, 52, 53) represent situations where the nerve lies superficially and where it is possible to excite a single motor nerve and muscles.

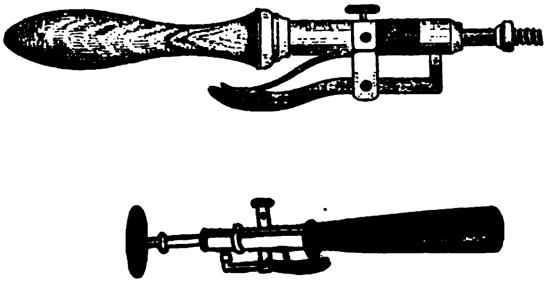


Fig. 47.—Interrupting electrodes. Between the connecting screw and the electrode surface there is a non-conducting hard-rubber plate. By pressing the spring, no current can reach the surface of the electrode, and by releasing the spring the current attains the electrode; thus by thumb pressure the circuit can be opened and closed without shifting the electrode.

Faradic Current.—The electrodes having been placed, one commences with a weak current, the strength of which is gradually increased until it is sufficiently strong to evoke a visible contraction of the muscle. The minimal strength of the current necessary to produce a contraction is shown by a scale, and is located at a point where the inner and outer coils overlap (C D—coil distance). Having tested each motor point, the corresponding side of the body may be used as a basis for comparison. Faradic stimulation of either the motor point or muscle, if the current is strong enough, will produce continuous muscular contraction during the flow.

Galvanic Current.—Both poles of the faradic current have practically the same action, but with the galvanic current there is a decided difference between the two poles. The cathode or negative pole is exciting, and the positive pole or anode is soothing. With a switch the direction of the current or polarity of the electrodes can be easily changed. If there is no switch, as in a portable galvanic current, if the electrodes are grasped, one in each hand, the electrode causing the more intense burning will be the cathode. Moistened violet litmus paper turns blue at the cathode and red at the anode. The electrodes are placed as before, one at the sternum and the small electrode on the motor point. One will note that by opening or closing the current (not during the passage of the current) by means of the button electrode, if the current is sufficiently strong, a muscular contraction is provoked. By means of the switch the small electrode is made the cathode. One observes the minimal current-strength necessary to produce muscular contraction by closure of the cathode. This fact may be ascertained by reading of the milliampèremeter. Next, by means of the switch, reverse the current so that the small electrode is the anode, and in the same way determine the minimal current strength necessary to produce muscular contraction by closure of the anode. Then test strength of current necessary to produce cathodal opening and anodal opening contraction. The following is the qualitative normal reaction of motor nerve and muscles to galvanic stimulation:

WEAK CURRENT.

Ca. C.C.:	slight contraction of muscle	An. C.:	no effect.
Ca. O.:	no effect	An. O.:	no effect.

MODERATE CURRENT.

Ca. C.C.:	vigorous muscular contraction	An. C.C.:	weak contraction.
Ca. O.:	no effect	An. O.C.:	weak contraction.

VERY STRONG CURRENT.

Ca. C.T.:	tetanic muscular contraction	An. C.C.:	vigorous contraction.
Ca. O.C.:	slight contraction	An. O.C.:	vigorous contraction.

In the just cited normal reaction stimulation proceeds from the motor points, and is regarded as the stimulation of a nerve. Ca.C.C. occurs normally at the motor points with a current intensity of 1 to 3 M.A. The formula cited holds good only when the muscles are indirectly stimulated with the galvanic current. In direct stimu-

PLATE VI.

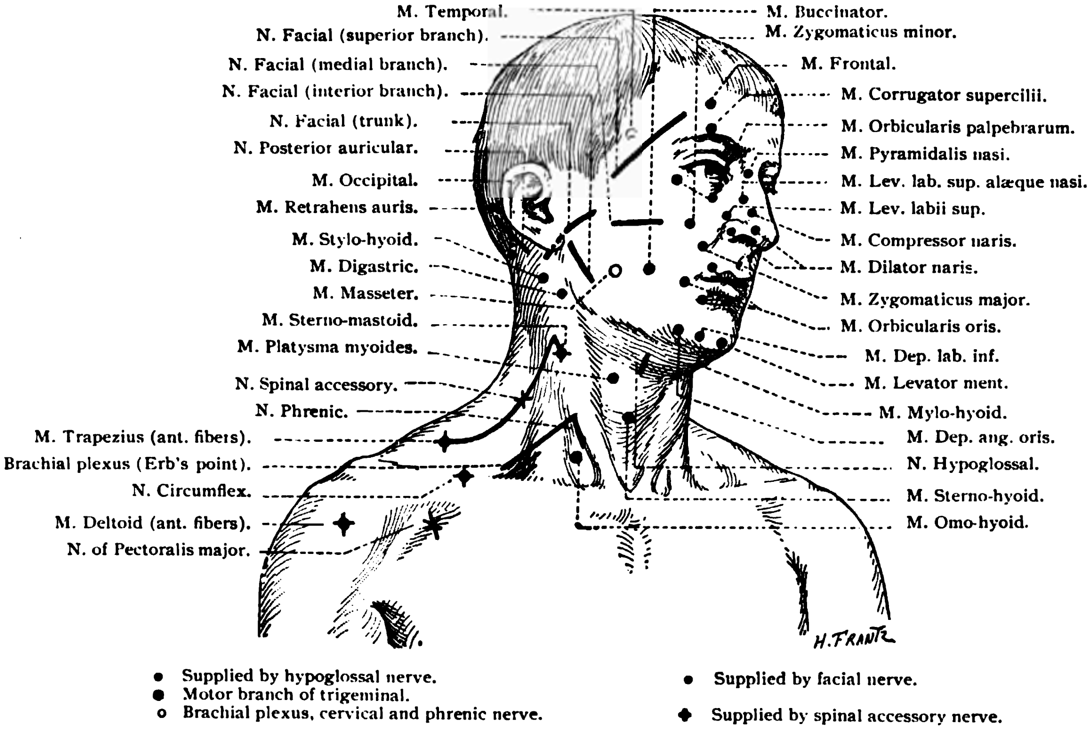


Fig. 48.--(From Guilleminot's "Electricty in Medicine.")

PLATE VII.

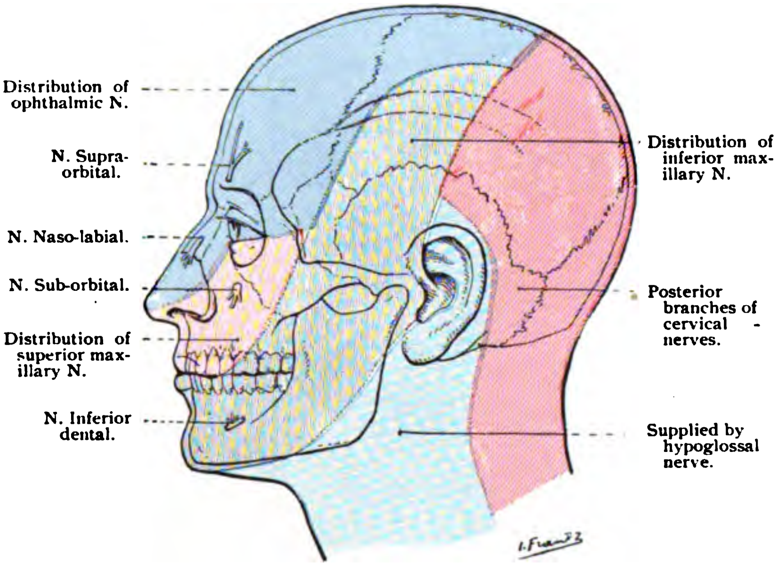
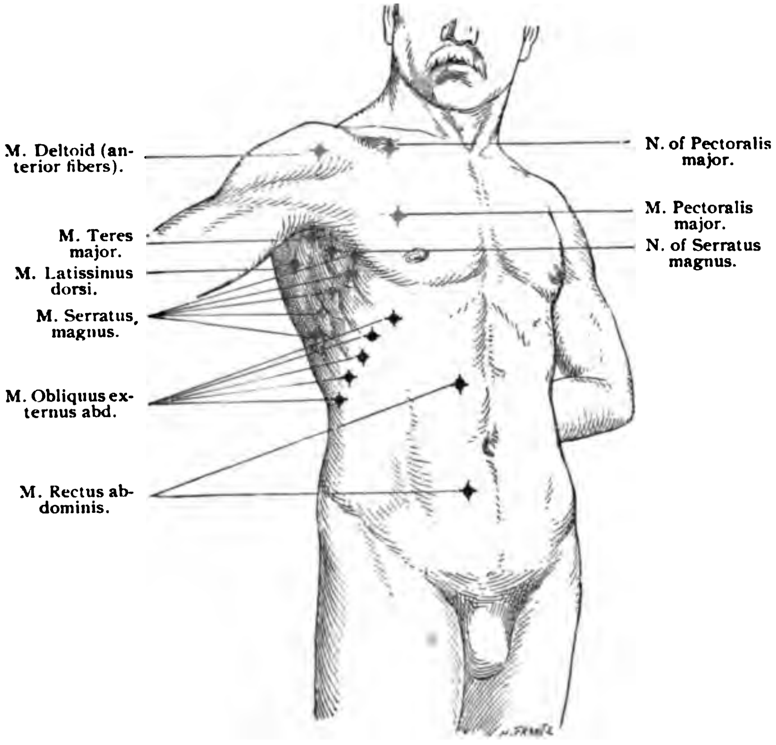

Distribution of ophthalmic N.
N. Supra-orbital.
N. Naso-labial.
N. Sub-orbital.
Distribution of superior maxillary N.
N. Inferior dental.
Distribution of inferior maxillary N.
Posterior branches of cervical nerves.
Supplied by hypoglossal nerve.

Fig. 49.—(From Guilleminot's "Electricty in Medicine.")

PLATE VIII.

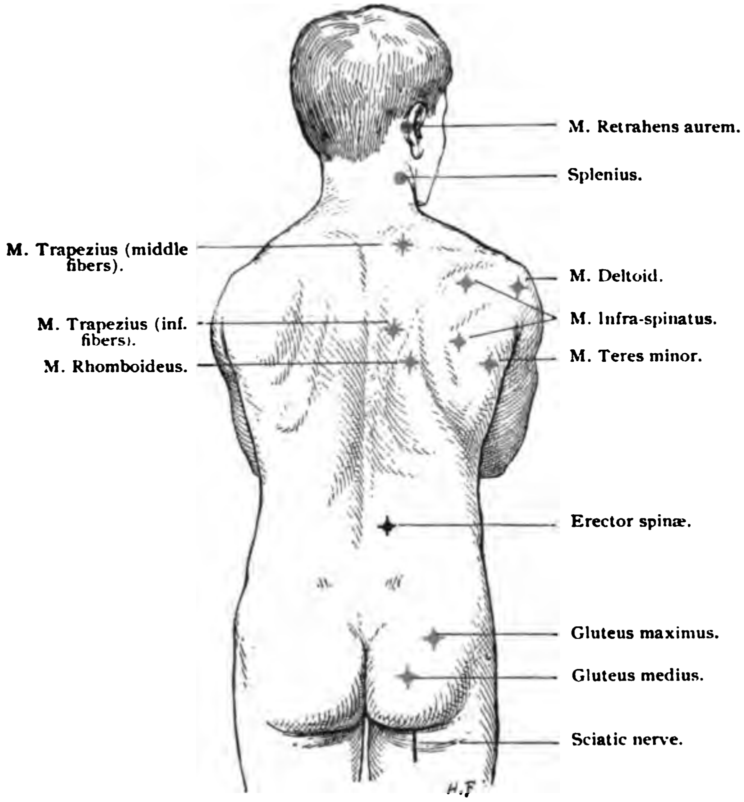


✦ Cervical plexus.

✱ Brachial plexus.

Fig. 50.—(From Guilleminot's "Electricity in Medicine.")

PLATE IX.



✦ Cervical plexus.

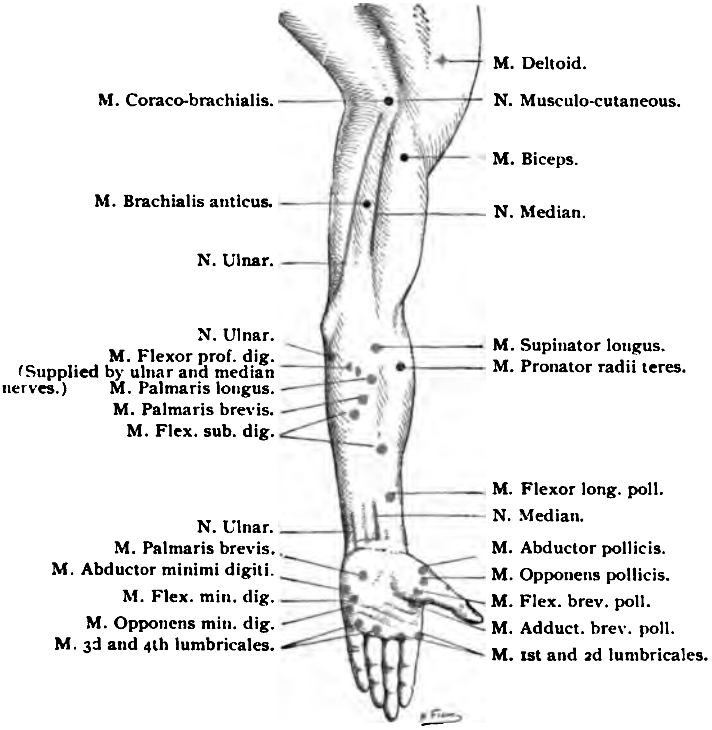
✧ Sacral plexus.

* Brachial plexus.

● Posterior branch of cervical nerve.

Fig. 51.—(From Guilleminot's "Electricity in Medicine.")

PLATE X.



● Supplied by ulnar nerve.

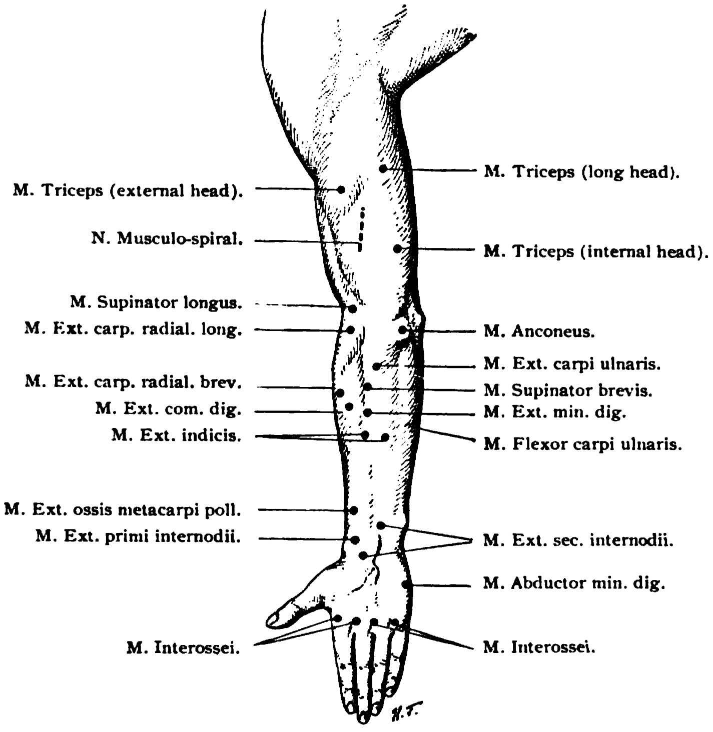
• Supplied by median nerve.

◆ Supplied by brachial plexus.

• Supplied by musculo-cutaneous nerve.

Fig. 52.—(From Guilleminot's "Electricity in Medicine.")

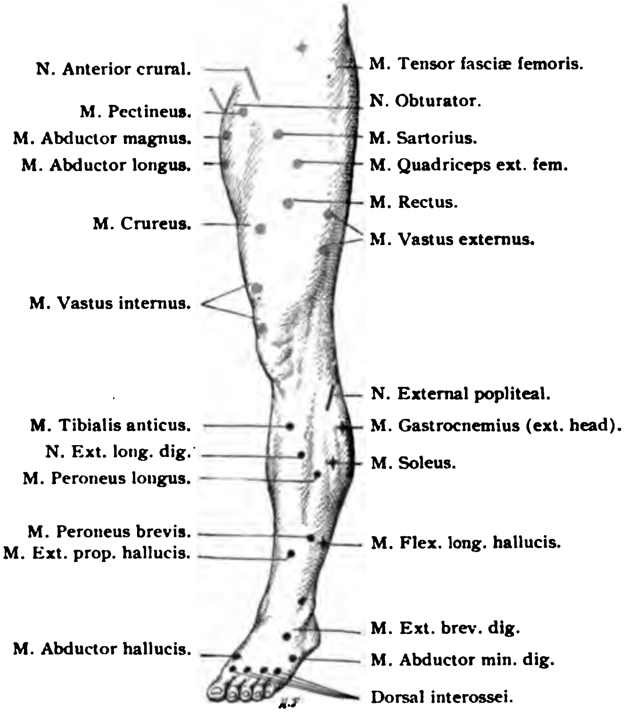
PLATE XI.



● Supplied by ulnar nerve.
• Supplied by median nerve.

Fig. 53.—(From Guilleminot's "Electricity in Medicine.")

PLATE XII.



✦ Sacral plexus; comprising tensor fasciæ, femoris, gluteus medius and gluteus maximus.

● Obturator nerve.

• Supplied by anterior crural nerve.

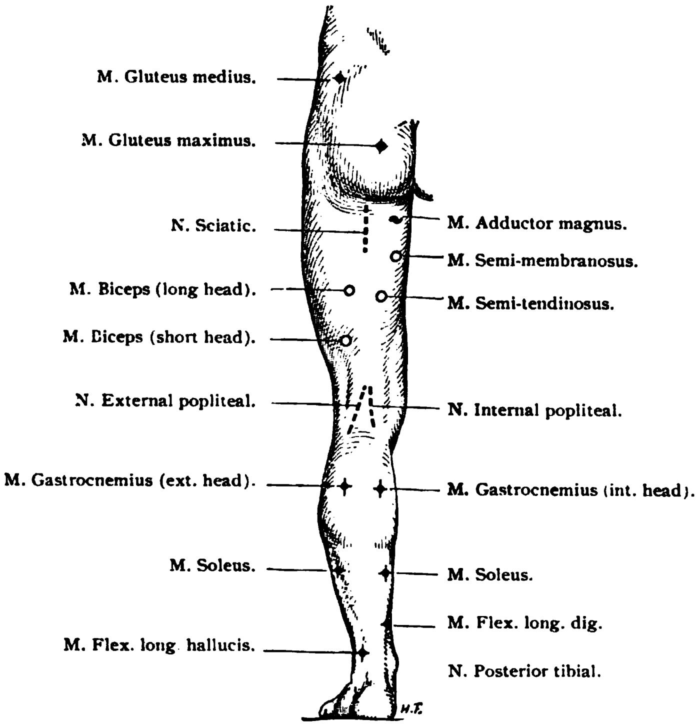
o Supplied by sciatic nerve before its division into external and internal popliteal.

✦ Internal popliteal passing into posterior tibial.

• External popliteal passing into anterior tibial and musculo-cutaneous.

Fig. 53A.—(From Guilleminot's "Electricity in Medicine.")

PLATE XIII.



◆ Sacral plexus.
● Obturator nerve.
○ Supplied by sciatic nerve before its division into external and internal popliteal.
◆ Internal popliteal passing into posterior tibial.
● External popliteal passing into anterior tibial and musculo-cutaneous.

Fig. 53B.—(From Guilleminot's "Electricity in Medicine.")

lation of the muscles (avoiding the motor points), there are only closing contractions, and An. C.C. may be equal to Ca. C.C. The muscular contractions are usually quick and sharp.

Reaction of Degeneration (D. R.).—

Faradic Current........	No muscular contraction by either direct or indirect stimulation (motor point).
Galvanic current........	No contraction by stimulation of the motor point. Direct stimulation of the muscle causes a sluggish contraction and the anode yields as good or a better response than the cathode.

Partial Reaction of Degeneration.—There is only a diminished irritability by either direct or indirect stimulation of the muscle by means of the faradic current, but with the galvanic current the reaction is the same as in the complete reaction of degeneration.

Myotonic Reaction.—This is observed in Thomsen's disease, and is a persistent muscular contraction after the current ceases to flow. The An. C.C. is often more vigorous than the Ca. C.C. In this disease (myotonia congenita) Erb's waves are occasionally found when a strong galvanic current is used through the muscle. They are wave-like movements of the muscle passing from the cathode to the anode.

The neurotonic and myasthenic reactions have been described, but they are of no real value in diagnosis.

Diagnostic Value of the Electrical Reactions.—The reaction of degeneration will exclude disease of the brain and all functional paralyses. If the faradic and galvanic reactions are normal, diseases of the anterior horns and roots of the peripheral nerves can be excluded. A partial reaction of degeneration shows anatomic changes in the muscle, but not in the nerves. In curable cases showing the reaction of degeneration, the voluntary power of the affected muscle is restored sooner than the electric irritability. As before remarked, the D.R. is present in all peripheral lesions of the motor nerves, whether of traumatic, rheumatic, toxic, or diphtheritic origin; also in diseases of the gray matter of the anterior horns of the spinal cord and gray nuclei of the medulla. The D.R. is absent in all cerebral and spinal paralyses, the cause of which is central from the trophic center.

Prognostic Value.—In rheumatic facial paralysis if the D.R.

is present after fourteen days* of the paralysis, it indicates either that months may elapse before a cure is effected or that the affection is incurable. If, however, after the lapse of fourteen days, no pronounced changes in the electrical reactions occur, the paralysis is slight and recovery is assured in several weeks. If there is a partial D.R. after fourteen days, recovery will ensue in eight to nine weeks. Even though no reactions are obtained after the first examination, treatment should be continued, for any reaction subsequently occurring may be regarded as favorable. In infantile spinal paralysis, if no D.R. occurs after three weeks in the affected muscles, the prognosis will be good, but if D.R. is present, recovery of the involved muscles is hopeless. In central lesions the electric irritability of the muscles is not usually changed, but should qualitative or quantitative change occur, it would indicate secondary involvement of the peripheral motor neurons.

Diagnostic Faradotherapy.—When we desire to make *acupuncture,* it is difficult to locate the site of the pain, but this may be accomplished with the faradic current, the muscular contractions being more painful over the affected areas. Similarly, in differentiating muscular from other pains this current is equally efficient. In *hysteria* Cohn[97] advocates the "surprise treatment": The patient is told that the symptom in question will be removed by one electrization. A strong faradic current is employed and the electrode is applied to the affected part (laryngeal region in aphonia, to the brachial plexus in paralysis of the arm), where it remains a short time, when the patient is suddenly commanded to utter a sound or move the arm. This maneuver is repeated at short intervals, each time making the same suggestion firmly and quietly to the patient. This method often succeeds and it often fails.

Clonic or tonic *spasm* of a muscle is not an infrequent phenomenon, but the confinement of a tonic spasm to a part of a single muscle is a manifestation rarely referred to. I have described such cases and encounter them frequently in my practice. Associated with the muscles of the neck, they are frequently mistaken for tumors or enlarged glands. Encountered in the abdominal muscles of the ileocecal region, they are supposed to be connected with an appendicitis. Here the faradic current, by immediately relaxing the spasm, proves of diagnostic value. *Rheumatism* of the cervical muscles is frequently confounded with a throat affection, owing to the dysphagia. This rheumatism may occur either independently or in association with affections of the throat. With the latter, the painful points in the neck are localized in the lymph-glands, whereas in muscular rheumatism the pain is diffused and brought into prominence when the cervical muscles are brought into voluntary contraction. The faradic current may dissipate the muscular pains at a single séance.

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* When a motor nerve is cut off from its trophic center, or if the center is diseased, paralysis occurs and the nerve degenerates and extends to the muscle supplied by it. At once the nerve shows diminished irritability for both currents, and after eight to fourteen days the irritability is entirely lost. Direct faradic irritability of the muscle is also entirely lost. After two weeks direct galvanic irritability of the muscle is increased and contractions which are long and slow occur with mild currents. In severe cases the galvanic irritability is finally lost after four to eight weeks.

Franz Berger has studied the problem of the differentiation of neuralgia and *toothache*. He has found that the faradic current offers an excellent means of detecting diseased teeth. The faradic current, when applied to the well-dried teeth, if they are healthy, causes only a tingling sensation; but if the teeth are diseased, severe pain is occasioned. In the case of a woman whose teeth were handsome and appeared healthy, severe and intractable neuralgic pains had persisted for more than a year. By means of the method just described it was discovered that two teeth were diseased, and on devitalizing their nerves the pain promptly disappeared. If a tooth is dead, there is absolutely no sensation. Naturally, the sensation in a filled tooth (with metallic filling) will be very much exaggerated. Burchard and Woodward have shown that if the positive electrode of a mild galvanic current is applied to the dentine or a metal filling in a vital tooth with the negative pole in the hand of the patient, a distinct sensation is felt, but is absent in a devitalized tooth.

In *otosclerosis*, according to Tsitovitch, the tensor tympani muscle is weakened or does not act at all. Here faradization may be employed and diagnostic conclusions may be formulated if it increases the power of hearing, improves the capacity for accommodation, or causes an improvement of tinnitus. The electrode is introduced into the orifice of the Eustachian tube, the tip of the electrode being pressed against the upper wall thereof. The second electrode is placed in the angle between the lower jaw and the mastoid process. The strength should differ in each individual, and, as a rule, the strongest current that can be borne should be employed. The duration of each treatment should be from three to five minutes, and the frequency at least three times a week.

In *cardiac neurasthenia* painful areas may be located by pressure in the precordial region and the evanescence of these areas of pain by local faradization is an important aid in the diagnosis and treatment of many cardiac neuroses.

Faradic Albuminuria.—Reference is made to albuminuria resulting from renal massage (page 572). An attempt was made[28] to induce the same result in kidneys inaccessible to palpation. The faradic current was used as follows: An electrode 10 cm. square was placed upon the lumbar region in an oblique direction with its upper border at the tenth rib, the other electrode in the shape of a disk (10 cm. in diameter) was firmly fixed in the hypochondriac region as profoundly as possible in the direction of the kidney. The subject is seated leaning slightly forward. The current must not be strong enough to provoke pain or muscular contractions and the duration of the sitting is fifteen minutes for each kidney. The urine is examined before and again at intervals of twenty minutes after faradization. In 54 per cent. of the pathologic cases in which albuminuria existed the amount of albumin was at least doubled after the séance. In fifteen cases when the kidneys were healthy, notable albuminuria was induced once, slight albuminuria in nine, and no albuminuria in five cases. In some cases the sediment of the urine was also modified and pre-existing elements increased. Curschmann's investigations with the faradic current on *blood-pressure* are interesting. In the norm avoiding motor points of irritation, the blood-pressure is generally increased; in persons with organic or functional hypertension, the increase is disproportionately greater. In organic analgesia there is no change in the pressure, and this is also true in hysteria until the latter is cured. This shows that the analgesia in the latter affection is due to an actual sensory lesion.

Diagnostic Galvanotherapy.—The late Dr. Moebius, a nerve specialist of great reputation, asserted that four-fifths of all electrical cures are dependent on mental influences. Beard, who in his time was one of the leaders in electro-therapeutics, said, "If you expect to get definite results from electrical applications, you must be sure that your patient has faith, otherwise the application will do him no good." If the physician wishes to enhance the psychic action of electricity, his apparatus must be ostentatious and complicated, and his current must be employed in such a way as to get striking effects like muscular contractions, reddening of the skin, flashes of light before the eyes, a moderate amount of pain, etc. Electricity is a good suggestive agent in *hysteria.* Thus, if the patient's attention is directed to the contracted muscles, it is an evidence that the latter are still active and that the electricity furnishes them with vitality. Immediately after the application the patient must attempt to execute the same movements made by the faradic current. Electrotherapy is now founded on a scientific, and, what is more important, a utilitarian basis. All currents do not show like physiologic and therapeutic effects, any more than do the various opium alkaloids, although the same plant is the common source of all. *Gastralgia* as a neurosis is not an infrequent symptom in hysterical women, and it is often difficult to distinguish between it and gastric ulcer. Leube[96] uses the galvanic current during digestion with the anode to the gastric region. If the pain is entirely inhibited, it would speak in favor of gastralgia. In the angioparalytic forms of *hemicrania* accompanied by paleness of the face, the current, with one electrode on the forehead and the other to the nape of the neck, often gives decided relief, and cures may result from persistent treatment. The constant current is of value in testing the reaction of the *gustatory nerves;* it causes perceptions of taste; an acid taste at the positive, and an alkaline-burning at the negative pole. In *tetany* the electric excitability of the nerves to the galvanic current is very much increased, and even feeble currents may produce cathodal closure tetany, anodal opening tetany, or even cathodal opening tetany. The augmented irritability to the faradic current is less constant. The diminished resistance to galvanic conduction in *exophthalmic goiter* is caused by the inclination of the patients to perspire. In Thomsen's disease (myotonia congenita) the myotonic reaction is characteristic: the mechanic and electric irritability of the motor nerves is slightly decreased, but the irritability of the muscles is increased. Strong faradic currents provoke marked and sluggish contractions of the muscles, which persist after cessation of the current. Anodal closure contraction with the galvanic current is persistent. Percussion of the muscles, or even pressure with the finger, causes a tonic sluggish contraction of the affected muscles which persists after the irritation has ceased.

Detection of the Emotions.—If each hand of a person grasps an electrode and a moderate galvanic current passes through the body, the needle of a galvanometer will in the norm show a deflection, but the needle remains stationary. If, however, certain words are spoken by the physician in the ordinary course of conversation, which bear on the emotional life of the individual, there is a sudden increased deflection of the needle after a latent period of several seconds. In this way the physician ascertains facts buried in the subconscious mind, and by analyzing them employs an important psychotherapeutic method. Tarchanoff has shown that the emotions increase the activity of the sweat-glands, and the augmented quantity of liquid in the lower layers of the skin diminishes electrical resistance, hence the increased deflection of the needle.

Test of Suggestibility.—Suggestion is common to all psychoneuroses and is not limited to hysteria. Bechterew's differentiation between persuasion and suggestion is as follows: the former enters the understanding by the front door and the latter by the back stairs. If the wires of an electric battery (not in action) are connected by means of electrodes with the hands of the patient and the rheostat so manipulated as to suggest increasing the force of the current, the patient with exaggerated suggestibility will experience all kinds of sensations.

Cataphoresis is often efficient for the deposits of a gouty joint: The negative pole is placed on the back or chest and the positive pole, kept wet with a saturated solution of potassium bicarbonate, is applied to the joint. Strong currents (10 to 30 milliampères) must be used. If relief follows, one cannot affirm that the deposits are necessarily gouty, insomuch as rheumatoid arthritis is also benefited.

To increase the *flow of blood in the brain* the cathode of the constant current is placed on the forehead and the anode on the nape of the neck. To relieve congestion the position of the electrodes is reversed.

Diagnostic Sinusoidalization.*—One peculiarity of this current, as compared with the faradic and galvanic currents, is the absence of pain when the latter are employed in sufficient strength to induce equally powerful muscular contractions. It is probable that the rapidity of alternations is so great that the sensory nerves fail to appreciate the impressions of such high frequency. Its penetrating power is very great, and it is serviceable when action on the deep-seated organs is desirable either from its stimulating or analgesic action.† The action of the current on the muscles is not merely mechanical, as Kellogg shows. By means of a surface thermometer, the skin temperature over the leg muscles brought into powerful contraction may be raised 3.2° F. in ten minutes. Application of the current to the abdomen drives the blood from the splanchnic pool to the heart, and this fact can be demonstrated by what I have called the cardiosplanchnic phenomenon.[90] In 1892, Mall demonstrated the vasoconstrictor fibers to the portal vein in the splanchnic nerve, and that through their stimulation 27 per cent. of the total blood could be displaced from the splanchnic area and driven forward to the heart. This current applied to the chest causes a powerful contraction of the heart and lungs (heart and lung reflexes of Abrams); to the abdomen, a contraction of the intestines (intestinal reflex), and to the half-moon

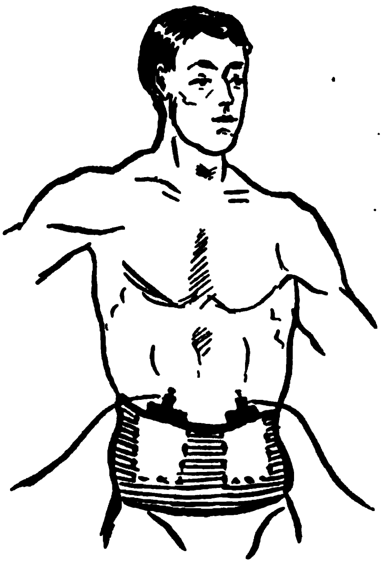

Fig. 54.—Method of application of the sinusoidal current to the abdomen. Large electrodes are fixed to the abdomen by means of a broad belt.

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* For a detailed account of this current *vide* author's work, "Man and His Poisons," New York, E. B. Treat and Co., 1906.

† If this current, of sufficient strength (positive pole over the painful points and negative pole at an indifferent point), is allowed to pass for at least ten minutes through a painful nerve, the latter will become painless provided the neuralgia is not of central origin. In this respect the action is equivalent to blocking the nerve with cocain (*q. v.*).

shaped space of Traube, a contraction of the stomach (Stomach reflex).

In "*intestinal auto-intoxication*" the current, as I have shown, may be employed in diagnosis. Both electrodes of a strong current are applied to the abdomen (Fig. 54) for about fifteen minutes. The urine is examined before and after the abdominal application of the current for indican and the ethereal sulphates.* These substances serve as an index of intestinal putrefaction. Some contend that if indican can be detected in the urine, even by a feeble reaction, it indicates that it is excreted in excessive quantity. Indicanuria indicates putrefactive fermentation of the proteid substances in the alimentary canal, for in perfect digestion of the proteids, it cannot be detected in the urine. Senator has shown that the urine of the newborn contains no indican, because in the intestine there is no putrefaction. In normal subjects, even though no indican is present in the urine before application of the current, traces could be detected after the application. If present before treatment, it is invariably increased after application of the current. In cases of auto-intoxication, the indican is very much increased after the application of the current, and with subsequent treatment on successive days the amount of indican excreted becomes less and less, and this diminished excretion runs parallel with the improvement of the symptoms of the disease.

The excretion of the ethereal sulphates is also increased after the use of the current. It has been shown that indol administered by the mouth even in small doses causes frontal headaches, irritability, and insomnia, and there is ample evidence to believe that many cases of neurasthenia owe their origin to the absorption of the products of putrefaction. Individuals vary in their susceptibility to the action of indol.

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* *Indican test* (Sahli): Pour a few cubic centimeters of hydrochloric acid into a test-tube and add a drop of chlorid of lime solution. (The latter is made of a half-saturated solution of commercial chlorid of lime.) Shake the mixture, and then the urine is carefully stratified upon it by letting it fall drop by drop upon the surface of the acid, through a filter. A blue-black ring of indigo forms at the line of junction of the two fluids. The greater the amount of indican, the deeper will be the coloration. In normal urine this test gives only a rose or faint violet color.

Sulphates: Add an excess of barium chlorid to the urine previously rendered strongly acid with hydrochloric acid, and a whitish precipitate of barium sulphate is formed. After allowing the urine to stand for several hours, the amount of the precipitate will indicate the quantity of ethereal sulphates. Like indican, the organic sulphates are increased proportionally by the putrefactive decomposition of proteid in the alimentary canal.

Indican and the sulphates are brought to absorption by improvement of the abdominal circulation by the sinusoidal current.

Intra-abdominal congestion is frequently associated with intestinal auto-toxemia, and very often it is the basis of an affection which I have described as *splanchnic neurasthenia.* The current in question is practically a specific in neurasthenic affections of this kind, hence the relief obtained is not only diagnostic but curative. In splanchnic neurasthenia the liver is extremely sensitive on palpation. One cannot always palpate the lower border of the liver, hence I have suggested the following method of *transmitted palpation:* fix the pleximeter over any part of the liver-region and then strike it a series of vigorous blows with a hammer. Pain or nausea following the blows indicates hepatic tenderness. It will be found that even after a primary application of the sinusoidal current, hepatic tenderness dependent on congestion disappears at once, for a time at least. I regard this sign as an important one in differentiating the sensitiveness of congestion from other conditions. *Motor insufficiency of the stomach* causes local symptoms of dyspepsia and general symptoms ranging from headache and dizziness to insomnia, inanition, and auto-intoxication. I have shown experimentally that the stomach can be brought to contraction (stomach reflex) and thus benefit the condition by the use of the sinusoidal current. One electrode is fixed in the Traube area (*i. e.*, the tympanitic area bounded by the borders of the liver, spleen, and lung, in which is situated the cardiac end of the stomach), the other at some point in the back: the longer the duration of each sitting with a strong current, the better.

In *myocardial insufficiency* the sinusoidal current with one electrode over the heart and the other between the scapulæ exceeds, in my opinion, any other cardiotherapeutic maneuver for the relief of this condition. After a limited séance, the pulse is reduced in frequency, becomes fuller, and dyspnea is less pronounced. Unless the pulse-changes are noted after the first application, little can be expected from further treatment. If anginal symptoms are present, they become intensified. In fact, several times I have unintentionally evoked the pains of angina pectoris by the use of this current. The current produces the heart reflex. Without being anatomically affected a valve may not be capable of closing a cardiac orifice in ventricular dilatation (*relative insufficiency*). In many instances a murmur of relative insufficiency is temporarily dispelled after the cardiac application of this current which produces the reflex and consequent narrowing of the orifices, thus enabling the valves temporarily to close them. In this way the current enables us to distinguish the murmurs of relative insufficiency.

Many neurotics owe their ***intestinal gas formation*** to a relaxation of the intestinal musculature. The sinusoidal current will provoke an intestinal spasm by inducing the intestinal reflex, hence in these cases the current by its curative action directs attention to the cause of the tympanites. Another factor involved in these cases is intra-abdominal congestion, which, as already shown, is amenable to treatment by this current. Reference is made to Fig. 55, which shows the perimeter (reduced) of the abdomen (*A*) before and (*B*) after the abdominal application of the current in a neurotic subject with tympanites.

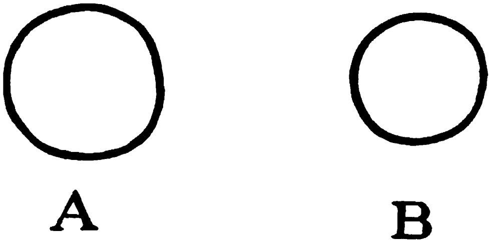

Fig. 55.—Perimeter of the abdomen, *A* before, and *B* after, the abdominal application of the sinusoidal current.

My theory of gas formation in many neurotics is as follows: I assume that the intestines and abdominal veins represent two chambers containing a mixture of gases in unequal amount; diffusion takes place until the percentage amount of each gas in each chamber is the same. Owing to stasis of blood in the abdominal veins in many neurotics, the veins contain a larger quantity of carbonic acid, hence the latter diffuses from the veins to the intestines. The intestines now become inflated and increase intra-abdominal tension, which in turn squeezes the blood out of the abdominal veins to the right heart. After this manner gas accumulation in the intestines is, as I view it, distinctly a process of compensation.

Lithemia: We often dignify fatigue symptoms by the phrase "uric acid diathesis." When we say that the joints, muscles, and ligaments are favorable sites for the precipitation of uric acid, what we ought to say is, that these structures are specially liable to congestion, and that the fatigue signs which graduate into pains are mere expressions of localized intoxications. If it is desirable to destroy these products of intoxication, it is necessary to bring a greater supply of blood to these parts, for more circulating blood means more oxygen, and more oxygen means better nutrition. There is no better substitute for exercise than the general application of the sinusoidal current to all the muscles. Its judicious application at a fifteen-minute séance is equivalent to a walk of several miles, plus the additional fact that we are exercising muscles that are usually not brought into action. Thus it is that fatigue-products accumulate and give rise to pains in unemployed muscles like those of the back. Examining the urine for urea before and after sinusoidalization of all the muscles of the body, I found that the urea output was usually augmented. Thus in one patient the urea was increased from 1.2 per cent. before, to 2.7 per cent. after treatment. Sinusoidalization of the muscles is equivalent to work, and if, as Voit and others have shown, that work does not increase the elimination of nitrogen by the urine, the increased output in my cases must be due to the removal of urea stored up in the muscles. A method such as described should be a good one for disproving or supporting the uric acid theory, for in supposed cases of uric acid poisoning the output of urea should be increased. It will be noted by the following record that the increased excretion of urea continues for at least twenty-four hours after treatment, thus making the discrepancy in the output before and after treatment less marked on the third day.

		Before Treatment.	After Treatment.
First day:	Urea	1.6%	2.1%
Second day:	"	2.3 "	2.6 "
Third day:	"	2.6 "	2.7 "
Fourth day:	"	2.4 "	2.7 "

Scars: Cicatrices, aside from producing deformities, often compress vessels and nerves, thus leading to reflex sensory disturbances. If the reflex pains are caused by a cicatrix, freezing the cicatrix or injecting cocain into the latter will temporarily inhibit the pains and thus demonstrate their origin. If more radical measures are indicated, *i. e.*, the removal of the scar, *thiosinamin* may be tried.

Lewandowski softens scars, and even effects their removal, by galvano-faradization. The application is made with two large electrodes moistened with a 10 per cent. salt solution. The negative electrode, which is applied to the sacrum, has an area of 30 square inches. This is connected with the positive pole of a galvanic battery. The negative pole of the battery is connected with the positive pole of the induction coil, and this electrode has a surface of about 16 square inches. The apparatus has a commutator that enables the operator to use either the galvanic or faradic current alone, or the two combined. The strength of the constant current employed is from 3 to 4 milliampères. The induction current should be sufficiently intense to provoke appreciable contraction of the muscles. Each treatment should last from fifteen to thirty minutes.

High-frequency Currents.—The primary source of energy of this current is either the static machine or induction coil. It is a current of high voltage, but with little volume or amperage. The voltage is increased when the current is transformed. In its application a low-vacuum electrode is usually employed and it is painless. The oscillations of the current are of such frequency that no impression is made on the motor or sensory nerves. The current favors oxidation and metabolism, as is demonstrated by augmented elimination of waste-products. It also yields ozone and ultraviolet rays. When employed for increasing elimination of waste-products, it is applied over the abdomen and spine and over the affected joints or nerves. When defective metabolism is suspected, this current may be employed, and the results, if favorable, would justify the correctness of the diagnosis. Many intractable affections of the skin show a decided and marvelous reaction to the current in question, and the same may be said of other local manifestations usually included under uric-acid diathesis.*

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* *Neuroses* are favorably influenced by the high-frequency current, whereas hysterical subjects react unfavorably and new symptoms are added to the old ones even after a single application. In fact, *latent hysteria* has been detected after this manner by Kahane, who employs this current in differential diagnosis.

GYMNASTICS (RESISTANCE AND RESPIRATORY).

Resistance Gymnastics.—There are many individuals with hearts incapable of resisting the burden put upon them, and the result is a dilatation of one or more of the chambers. The exciting causes range all the way from excessive exercises to the ordinary household duties. Anemia and nutritional disturbances are predisposing causes.

The acute cases of *overstrain* cannot escape recognition, but the chronic cases are often overlooked. Thus, an anemic woman who has unceasingly responded to the demands of an active social life, who says she is "worn out," often suffers from an overstrained heart. The subjective symptoms are lassitude, slight dyspnea on exertion, and digestive disturbances. Objectively, one may recognize dilatation of the ventricles by percussion, feeble heart tones, and a pulse which is rapid and feeble and may be irregular or intermittent. These cases, as well as those hearts which fail to respond to the tests of cardiac efficiency (chapter, diagnosis of visceral sufficiency), are benefited by resistance exercises. After the latter there is a remarkable decrease in the area of cardiac dullness; in fact, the decrease is so pronounced that Schott finds, in the effect, an aid in the differential diagnosis between a pericardial effusion and a dilated organ. In the former the area of dullness is unmodified. These exercises, like the carbonated baths, presently to be considered, are supposed to benefit the dilated heart cavities by diverting a part of their contents to the peripheral vessels. No doubt the chief action is to provoke the heart reflex, and, as I have repeatedly demonstrated, the heart reflex can be just as well elicited by tapping the muscles (*tapotement*) as by any system of complicated exercises, and the carbonated baths can be substituted by frequent vigorous cutaneous friction with equally good results. I have already referred to the action of the *sinusoidal current* for achieving the same results.

The resistance exercises consist of voluntary movements by the patient of flexion, extension, and rotation of the extremities and trunk, which are resisted by an attendant. The following must be observed:

1. The exercises must be made by an attendant who is trained in the work.

2. The exercises must be made slowly and there must be at least a pause of thirty seconds between each successive movement.

3. Any respiratory or circulatory embarrassment (dilatation of the nostrils, sighing, irregular breathing, pallor, perspiration, and palpitation) calls for an immediate arrest of the exercises, and the patient must be allowed to rest completely before the movements are resumed.

4. The breath must not be held during the exercises and the muscles not exercised must be relaxed.

5. No movement is to be made twice in succession.

6. Certain exercises, like elevation of the arms above the head and body-exercises, are trying, and must be avoided until the patient's endurance is better established. Similarly the force employed by the attendant should be even and never great enough to cause the patient the slightest discomfort. The sittings should be gradually increased in duration and the same applies to the force employed.

7. The attendant must never grasp the limbs nor constrict them in any way, and all resistance is to be made either with the palm of the hand or by forming a fork with the thumb and fingers. The patient must be informed that the object of the exercises is to improve his heart and not his muscles, otherwise more resistance will be offered than is essential.

The treatments may be taken daily or every other day according to the strength and reaction of the patient. Patients in fairly good condition may take the exercises twice daily. The exercises, like the Nauheim baths, cause the pulse to become slower, fuller, and regular, if previously irregular, and to diminish the area of cardiac dullness. The exercises and the baths can be as harmful as beneficial, and the physician must be prepared to continue or discontinue them according to the results. The following movements are recommended by Schott:

I. The arms are to be raised slowly outward from the side until they are on a level with the shoulder. After a pause they should be slowly lowered.

II. The body should be inclined sideways as much as possible toward the right, and then to the left.

III. One leg should be extended as far as possible sideways from the body, the patient steadying himself by holding on to a chair. The leg is then dropped back. The same movements are repeated by the other leg.

IV. The arms are raised in front of the body to a level with the shoulder, and then put down.

V. The hands are rested on the hips, and the body is bent forward as far as possible, and then raised to the upright position.

VI. One leg is raised with the knee straight, forward as far as possible, then brought back. This movement is repeated with the other leg.

VII. With the hands on the hips, the body is twisted round as far as possible to the right, and then again to the left.

VIII. With the hands resting on a chair and the back stiff and straight, each leg is raised as far as possible backward, first one, then the other.

IX. With the fists supinated, the arms are extended outward, next inward at the level of the shoulders.

X. Each knee is first raised as far as possible to the body, and then the leg extended.

XI. This movement is the same as IX, but with the fists pronated.

XII. Each leg is bent backward from the knee and then straightened.

XIII. Each forearm is bent and straightened from the elbow.

XIV. The arms are brought from the sides forward and upward, then downward and back as far as they will go, the elbows and the hands being straight.

XV. The arms are put at a level with the shoulder and then bent from the elbow inward and again extended.

XVI. With the arms in front at the level of the shoulder and the hands stretched, the arms are opened out sideways and then brought together.

XVII. The arms are bent from the elbow, lifted outward and extended.

Resistance gymnastics, as before remarked, are recommended by Schott to distinguish in doubtful cases a dilated heart from a pericardial effusion. Within half an hour after the resistance movements, the diffused cardiac dullness caused by dilatation of the heart will recede, whereas the dullness of a pericardial exudate is uninfluenced by the gymnastic exercise.

Nauheim Baths.—These baths, in connection with the exercises, constitute the Schott treatment of heart disease, and are indicated in properly selected cases of cardiac insufficiency. When the indications cannot be recognized, then one must be guided by the results. The following are regarded as contraindications to the use of the baths: Aortic aneurism, severe grades of arteriosclerosis, and cardiac inadequacy.

Bad Nauheim, in Germany, is visited yearly by thousands of patients afflicted with cardiac disease, and the baths at Nauheim are now recognized as most efficient in such diseases. The waters owe their action to various chlorid salts and to the presence of carbonic acid. Thus the patient immersed in the bath is subjected to a constant stream of effervescing water and is covered with minute bubbles of carbonic acid gas. For those who are unable to take the natural baths, artificial baths are equally efficient. An advantage in going to Nauheim is that the patient abandons all business cares and devotes himself entirely to getting well. Disadvantages are: the long journey, which all cardiopaths cannot tolerate, and the influence of propinquity. The mental influence of health resorts on some patients is very depressing. A typical case of heart disease, like that of phthisis, includes the whole field of pathology. The moral and mental condition of the cardiopath is as badly implicated as his physical health. He is susceptibly a creature of his environment, and addicted to the gossipy talk of invalidism and to the mental depression which that state suggests.

In the employment of the artificial baths, one must emulate the practice at Nauheim:

1. The temperature of the water of the first bath averages from 93° to 95° F., and should not exceed seven minutes. A short immersion stimulates and a long immersion depresses. From the fourth day on, the temperature of the water may be diminished one degree and the duration of the bath may be extended one minute. Thus at the end of the treatment, if the baths are tolerated, the

temperature reaches about 86° F. and the duration about twenty-five minutes. The cooler the effervescing baths, the greater the stimulation, hence only the warmer baths are tolerated by patients with a weak heart.

2. If the baths are favorable in their action, one should note some improvement even after the first bath. Breathing is easier and deeper, the sensation of oppression is less pronounced, and the pulse becomes slower, stronger, and more regular.

3. The patient takes no part in the preparation of the bath. He must be assisted in entering and leaving the bath. He must remain absolutely quiet in the bath. After the bath, he should be dried and must rest in bed for at least an hour. He must not be covered with blankets to provoke perspiration, which is undesirable. A hot-water bag may be used if the patient is chilly.

4. To prevent depression, one bath is taken daily for three successive days, and then comes a day of rest. The full course of baths at Nauheim consists of about forty baths. Twenty of these are taken with an interruption on every fourth day, and then the patient is sent away for rest and moderate exercise. Then he returns to take the remaining baths, which constitutes what is called the "after-cure."

5. The resistance exercises are used as a part of the treatment and are given an hour or two before the bath. Massage may substitute the exercises when the latter cannot be given by a competent attendant.

6. The diet in connection with the treatment is as follows: All stimulants are forbidden and wine is only used by those who absolutely need it. Liquids are diminished and not even soup is permitted. Any food tending to produce flatulency is prohibited, such as, potatoes, fresh bread, cabbage, carbonated waters, etc. Food, however, must be given in quantities to supply the demands of nutrition. Some do not employ the exercises until good results have first been achieved by the baths, when they are used with the latter or substitute them.

The following results may be summarized if the carbonated baths are efficient:

1. A sensation of warmth.
2. Augmented pulse-volume with diminished frequency.

3. Stronger cardiac systole.
4. Diminished area of cardiac dullness.
5. Amelioration of precordial distress.
6. A feeling of well-being.

Heitz[389] shows that the cardiac reflex of Abrams is a good guide by which to determine the probable effect of a contemplated balneologic treatment. If the size of the heart does not change under the excitation of the reflex (by sharp blows over the precordial region) the treatment will be ineffectual or may even be contraindicated on account of the probable development of cyanosis. In very large dilatations and in advanced myocardial degeneration, the heart does not respond to pericardial excitation and is not favorably influenced by baths. If the reaction is feeble, good results may be achieved, but the treatment must be used cautiously.*

Artificial Baths.—There are a number of firms who prepare already for use packages containing soda and tablets with directions for making "effervescent baths." The evolution of gas is abundant and continuous. The tablets are corrosive, and to protect the bottom of the tub a rubber sheet is used. The baths may be imitated as follows: Dissolve in the bath about 7 pounds of sodium chlorid, 10 ounces of calcium chlorid, and ½ pound of sodium bicarbonate. When the patient is in the bath, invert into the water a corked bottle containing 12 ounces of hydrochloric acid (25 per cent.). When the mouth of the bottle is below the surface of the water, remove the cork and distribute the acid evenly in the water. The baths are also efficient in other affections (*vide* antipyretic treatment, Chapter II).

Respiratory Gymnastics.—It is impossible to do justice to this subject in diagnosis without considering in detail many important facts concerning the respiratory apparatus. Unless such facts are recognized, errors in diagnosis are unavoidable. This subject is further discussed in the chapter on diagnosis of visceral sufficiency.

Thorough lung ventilation is of indisputable importance in the prevention and treatment of respiratory diseases. By its aid we are in a position to regulate the oxygen supply and the elimination of the respiratory excreta. The organism is, according to Bouchard's conception, a receptacle and laboratory of poisons. Were it not for special avenues of excretion, man would succumb to auto-intoxication. The lungs are important avenues for the elimination of poisonous substances, many of which are scarcely known. We may also regulate the local and general blood- and lymph-circulations. Such effects are not only local, but general, for every protoplasmic unit of the body, to live, must have its essential quantity of oxygen, and, receiving this, yields in return its products of activity. The physiologic principles involved in respiration are not always strictly in accord with clinical observation. By this I mean that civilized man has so subverted primeval respiration, by attire and modes of living, that what is now regarded as physiologic is really pathologic. Physiology teaches that the lungs, even at the termination of expiration, are in a stretched condition, and the experiment is frequently cited of making an opening into the pleural cavity, which drives a certain amount of air into the trachea. Without entering further into a discussion of this matter, let us learn to what degree such physiologic teaching is in conflict with clinical evidence. The lungs do not by any means fully occupy the thoracic space. The costal and visceral layers of the pleura make up a sac in which, so to speak, the lungs are let in. In certain thoracic situations the pleural sac is larger than the lung-volume, and forms spaces, known as pleural or reserve spaces. Such spaces permit of changes in the lung-volume which otherwise would be impossible. The pleural spaces exist throughout the entire extent of the lung borders, the largest, known as the *sinus phrenicocostalis*, being located at the lower outer lung-border at a point where the costal passes over into the diaphragmatic pleura. Figs. 56 and 57 show the sites of the pleural spaces (shaded) on the anterior and lateral aspects of the thorax. Even the deepest inspirations are not sufficient to cause the lungs to fully occupy the pleural spaces. The pleural space on the lateral aspect of the thorax may be filled, if the patient lies on the opposite side and conducts deep and forced inspirations. In quiet respiration the difference in the position of the lower lung-borders during the respiratory phases is about 1 cm., whereas, if the respiratory excursions are more pronounced, especially in the lateral chest-region, the difference may be as great as 13 cm. This active mobility of the lung-borders is always greater than the passive mobility, which is influenced by the body-posture.

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* Dr. Bloch, of Franzensbad, uses carbonic acid douches for producing contraction of the heart, based on the fact discovered by Dr. Abrams, of San Francisco, that friction of the precordial region will produce contraction of the heart (Satterthwaite)."

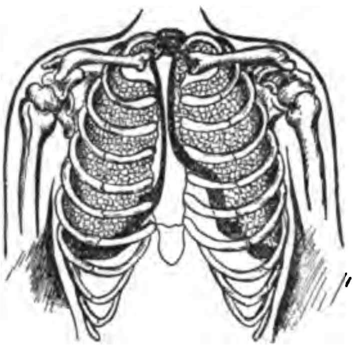

Fig. 56.—Pleural spaces (shaded).

Having succinctly reviewed these anatomic facts, we will now present the clinical findings, which contravene the assumption of the physiologist, that the lungs are always in a stretched condition. I have frequently directed attention in the literature[100] to constant areas of diminished lung-resonance varying from dullness to flatness as obtained by percussion. In number and situation these areas vary, but they admit in the aggregate of definite localization. These areas of dullness, or *atelectatic zones* (Figs. 58, 59), as I have called them, possess one characteristic feature—they may be dispelled by repeated forced inspirations. By this simple maneuver resonance will supplant dullness. The atelectatic zones are dependent on circumscribed pulmonary atelectasis or collapse of limited portions of the lung, and are dissociated with any demonstrable lesion. While it is true, from the standpoint of the physiologist, that the lungs are in a stretched condition, it is equally true from the position of the clinician, that certain portions of the lungs are collapsed and deprived of sufficient air to yield a dullness, and in some instances a flatness, on percussion. The atelectatic zones vary in size from a 25-cent piece to a dollar, or even larger, and are permanently absent when the lungs are emphysematous, and temporarily so after repeated deep inspirations, but they reappear in a few

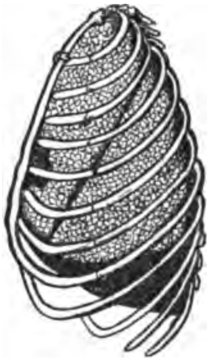

Fig. 57.—Pleural spaces (shaded) on the lateral surface of the left lung.

minutes when tranquil breathing is resumed. In Figs. 58 and 59 I have projected a composite picture defining the situation of the atelectatic zones, based on an examination of over a hundred apparently healthy persons, children as well as adults. On the posterior surface of the chest the zones are more frequently encountered, and admit of more definite localization than those on the anterior surface of the thoracic wall.

Since the advent of the Röntgen rays I have observed the following: (1) Atelectatic zones throw circumscribed shadows on the fluoroscope which will vary according to the degree and area of the pulmonary atelectasis. (2) The shadows cast by the atelectatic zones can be made to disappear by continuous forced breathing, and they will reappear after a variable period when quiet breathing is resumed. (3) Before deciding whether the shadow cast on the fluoroscope is really due to pulmonary consolidation, the subject should be instructed to make forced inspirations; if the shadow disappears, and is supplanted by a bright reflex, it is due to atelectasis; if the shadow persists, pulmonary consolidation may safely be concluded to exist, excluding, of course, other anatomic conditions that would interfere with the transmission of the Röntgen rays to the fluoroscope. (4) Radioscopy of the lungs demonstrates that the opacities on the fluoroscope, corresponding to the atelectatic zones, greatly exceed the percussional areas of the latter, and, furthermore, that in individuals in whom no zones can be demonstrated by percussion, opacities are sometimes

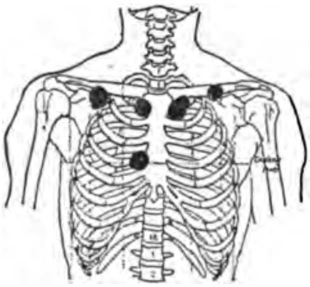

Fig. 58.—Atelectatatic patches on the anterior surface of the chest.

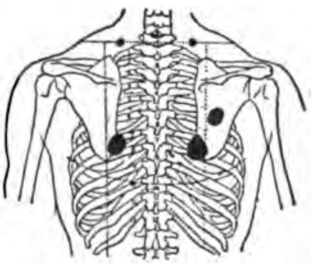

Fig. 59.—Atelectatic patches on the posterior surface of the chest.

present, which disappear after forced inspiration. (5) Before and during a radioscopic examination of the lungs it is always imperative to instruct the patient to practise forced breathing.

What are the practical conclusions that may be formulated as a result of the foregoing observations? (1) Danger may accrue from confounding the physical signs of atelectatic dullness with dullness caused by lung consolidation, an error which can always be avoided if the patient is directed to practise forced inspirations before percussion of the chest is attempted. Whenever a localized dullness of the lung is detected, it is a wise provision to instruct the patient to take a series of deep breaths; if the dullness disappears, we are dealing with an atelectatic zone; if, however, the dullness persists, we are justified in concluding that there is some lung anomaly. I hold that topographic percussion, as obtained ordinarily, is of inconstant value. The limitation of organs by percussion, especially the heart, will vary from day to day, and the percussional area of dullness in the same case and at the same time will be variously obtained by different diagnosticians. The borders of the liver, heart, and spleen are dependent on the degree of the lung inflation, and must vary according to the activity of respiration. Topographic percussion must always be based on the state of pulmonary inflation, and the results governed accordingly. The aid afforded by auscultation in the elimination of atelectasis is obvious. Auscultation of the lungs should be conducted with the patient in different postures, the object being to utilize the actual respiratory capacity of the lungs, thus eliminating the auscultatory phenomena of atelectasis and accentuating abnormal sounds which may be present. The recognition of the atelectatic zones is of the greatest importance to the skiascopist, as failure to recognize them may lead to the grave error of misinterpreting the shadows cast on the fluoroscope as evidence of lung tuberculosis. Any physician who places sole reliance on percussion, or the shadows cast on the fluoroscope, as evidence of lung consolidation, will commit the egregious blunder of interpreting tuberculosis in more than 50 per cent. of the patients coming to him for examination. In Fig. 60, A, we observe the fluoroscopic reproduction of the lung-apex in a normal individual. Note the area of luminosity represented by the apex in tranquil breathing (1). Observe how this area is augmented after forced deep breathing (2), and again after elicitation of the lung reflex (3). Observe the extraordinary increase in luminosity after strapping the lower chest, which permits of breathing in the upper chest only (*B*).

A word of caution is necessary to those who are desirous of confirming the latter observations. Owing to the extraordinary respiration in the upper chest-area, the clavicles may obscure by their elevation the luminous apical area; hence, the latter area should be gaged only when the patient practises forced expiration which will cause a descent of the clavicles. I have already mentioned the fact that the atelectatic zones may be dissipated by forced inspirations, but this is not always true, for there are instances when only repeated forced inhalations of compressed air will cause their evanescence. There are two methods which will cause their disappearance: by evoking the lung reflex, which will be referred to later, and by change in the posture of the patient. One finds that when the patient bends forward for a few seconds, the zones can no longer be elicited. This phenomenon I attribute to interference with the movements of the diaphragm which evokes compensatory costal breathing. Not infrequently the lung-apex in its entirety is atelectatic, and this may even occur in a condition of apparent health. Kernig confirms this observation, to which I have frequently referred. Experience has taught me to regard most highly the observation originally referred to by Seitz: the value of percussing the upper borders of the lung-apices for the earliest evidence of tuberculosis. Both apices rise usually to the same height (Fig. 61), as determined by percussion, and the latter sign shows that the apices rise during inspiration and fall during expiration. Any

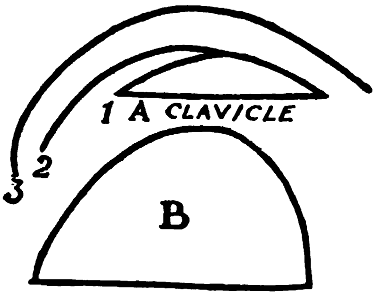

Fig. 60.—Fluoroscopic reproduction of the apex of the lung in a normal individual. *A*, 1, luminosity of the apex in tranquil breathing; 2, augmentation of the same after forced deep breathing; 3, increase of luminosity after elicitation of the lung-reflex; *B*, extraordinary increase in luminosity after strapping the lower chest, which permits of breathing in the upper chest only.

difference in the height of the apices, or any retarded dislocation during the phases of respiration, must always be regarded with grave suspicion. Fig. 61 shows the normal height of the apices. Owing to the difficulty experienced in the exact demarcation of the apices anteriorly, I rely almost wholly on the evidence furnished on the posterior surface of the chest.

Atelectasis bears an important relation to pulmonary tuberculosis and pulmonary anemia. In the former affection the zones bear an almost definite relation to the points of election and paths of distribution of the lesions in chronic pulmonary tuberculosis.

Postural Lung-dullness.—The author has never seen any reference to the fact that posture influences lung-resonance. If one percusses an individual first in the erect posture and then again when the patient leans far forward, the resonance in the former posture is translated into dullness in the latter posture. Similarly, the lungs become dull when the patient leans backward or to the side. In other words, the author believes that the pulmonary vessels being unprovided with vasomotor nerves, permits of the gravitation of blood in the lungs in the direction of the posture of the patient, and that the dullness is due to an increased quantity of blood in a given area.* The author further believes that many so-called cases of lung-atelectasis are in reality caused by congested lung-areas, and the differential diagnosis is as follows:

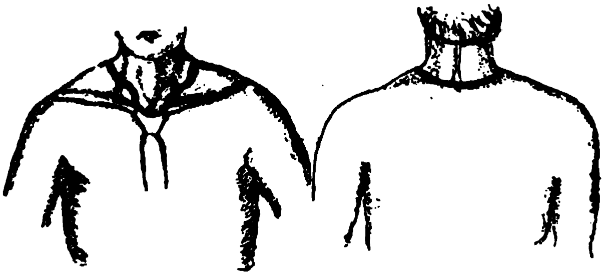

Fig. 61.—Extreme area of apical resonance obtainable by percussion on the anterior and posterior surfaces of the chest.

In atelectasis the area of dullness will disappear after repeated forced inspirations or by elicitation of the lung reflex; whereas in congestion (say the dullness is in the posterior thoracic region) the dullness will not completely disappear until the patient is placed in the prone posture. The foregoing facts are of importance in the postural treatment of lung disease. In tuberculosis I have noted that lung resonance is only slightly influenced by posture, hence I have such patients raise the lower end of their bed so that the apices bcome supplied with an abundance of blood.

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* The far-forward posture enables one to define the aorta by percussion, and any increase in the area signifies dilatation or aneurism of the vessel. The aortic area of dullness thus obtained corresponds with the dullness elicited in the aortic reflex of dilatation (*q. v.*).

Pulmonary Anemia.—In children, less often in adults, an anemia is often associated with atelectatic zones. This anemia I have designated as pulmonary. Pulmonary anemia attends multiplication or augmentation in area of the zones. The syndrome of anemia disappears after a course of methodic respiratory gymnastics, while its recrudescence is always associated with a reappearance of the atelectatic zones. Pulmonary anemia is not an invariable concomitant of lung atelectasis, although, as a rule, when anemia of pulmonary origin is present, atelectatic zones may be demonstrated. In association with the anemia, fatigue on exertion, dyspnea, and heart-palpitation, anomalies of digestion and constipation are usually present. Loss in weight is quite characteristic of pulmonary anemia, whereas in the essential anemias the well-nourished condition of the patient is manifest. There is another sign which distinguishes pulmonary from other forms of anemia,—the one exception being, perhaps, progressive pernicious anemia,—and that is, that while the ferruginous preparations benefit pure anemias, in pulmonary anemia they are practically valueless; at any rate, the benefit accruing from their use is evanescent. The real pathognomonic sign of pulmonary anemia is the therapeutic test. Subject such an individual to a single pneumatic cabinet treatment, employing inhalations of compressed air, and one invariably finds an increase in hemoglobin percentage if the anemia is of pulmonary genesis. The quantity of iron in pulmonary anemia is probably normal; the element lacking is oxygen; and this hypothesis is evidently correct, inasmuch as all my pulmonary anemics were cured by breathing exercises only. The recognition of pulmonary anemia as one of the earliest trustworthy signs of *tuberculosis* is of the greatest importance. I cannot adduce statistics in support of my contention, for that is a difficult matter. When, in the twenty years of my practice, I encountered an instance of pulmonary anemia, the patient was treated, and not subjected to scientific observation, so it is impossible for me to say how many of my untreated cases of pulmonary anemia would have terminated in bacillary tuberculosis. There are certain observations in medicine which must necessarily be purely empiric. I will instance a few observations which have some bearing on this subject:

Observation I: In a tuberculous family, of whom three members died of the disease, two daughters came to my office for examination. In one daughter atelectatic zones were variously distributed over the chest. Hemoglobin reduced to 60 per cent. Usual subjective symptoms of anemia. Treatment with the pneumatic cabinet. A period of five years has elapsed and the patient is still healthy. The other daughter also had the subjective symptoms of anemia and the hemoglobin was reduced to 70 per cent. Only one atelectatic zone was present, situated on the anterior surface of the chest close to the manubrium sterni on the left side, and about three inches in circumference. This patient underwent no treatment. Two years later she returned to my office with pronounced tuberculosis. Cavitation of the lung corresponding to the atelectatic zone previously mentioned was evident. Six months later the patient died.

Observation II: A young man, aged sixteen. Pronounced evidence of anemia. Atelectatic zones present. Treatment with the pneumatic cabinet of short duration. Three years later the patient died of tuberculosis.

Observation III: Girl, aged fourteen. Hemoglobin reduced to 50 per cent. Red corpuscles reduced to 70 per cent. Atelectatic zones present. No other symptoms. One year later patient presented herself with symptoms of pulmonary tuberculosis. Patient cured.

The foregoing observations have been selected from a small number of analogous cases, and only justify the importance I have attached to pulmonary anemia as an early sign of tuberculosis. If pulmonary anemia is dependent on lung atelectasis, as I have attempted to show, the treatment indicated is lung development. All my patients showed immediate and permanent improvement after daily inhalations of compressed air. The color of the patients improved, the oxyhemoglobin and number of red corpuscles increased, and the subjective signs of anemia disappeared. Whenever the organism is compelled to dispose of more oxygen, it produces more oxygen-carriers. If relapses occurred, which were not infrequent, they were attributed in the main to neglect of lung gymnastics or a return to former modes of life. Atelectasis is not the only evidence of ill-developed lungs, for its antithesis is nearly as frequent. This paradox deserves explanation. While atelectatic patches are limited to the upper, *emphysema* is limited to the lower chest and lung borders. Recalling elementary facts in the physiology of respiration, we know that as the lungs expand with each inspiration, their position changes somewhat in relation to the thoracic wall. The roots, the posterior borders, and the apices remain nearly stationary, whereas the anterior parts move downward and inward, so that their inner borders in front approach one another. Now, the air entering the lungs follows the direction of least resistance, hence the lower anterior lung-region, all things being equal, receives a larger amount of air than other pulmonary areas.

Over the lung, like any other organ containing air, percussion yields a clear sound, and is called pulmonary resonance. If we percuss the chest during forced expiration, we will find that the resonance is supplanted by dullness, and even by flatness, depending upon the capacity of the individual to expel the amount of reserve air during expiration. One characteristic sign of *vesicular pulmonary emphysema* is a similarity of the percussion note of the lungs during inspiration and expiration. Observation has taught me that the same phenomenon, viz., unchanged percussion tone during inspiration and forced expiration, is an early symptom of the pretuberculous stage of tuberculosis. We must assume, then, that in individuals predisposed to tuberculosis, and in those who already have the disease, the lungs are practically in an emphysematous condition, viz., dilatation of the air-vesicles, with disappearance or loss of tone of the elastic fibers. It is the latter condition which prevails, as I have assured myself by repeated histologic examinations. It is most probable that individuals who have tuberculosis, or who are predisposed to the disease,—which is practically what we mean when reference is made to the pretuberculous stage,—show a most palpable defect in the act of expiration. Accompanying this unaltered percussion note, we have a dislocation downward of the lung-borders and a diminution and even obliteration of the cardiac and splenic areas of absolute dullness—conditions which obtain in emphysema. Since the use of the Röntgen rays in thoracic examinations, all observers are agreed that *limited respiratory excursions of the lungs* is a characteristic sign of tuberculosis, yet, to my knowledge, no reason has been adduced in explanation of this limitation in the movements of respiration; the lungs in tuberculosis are in a permanent inspiratory position, and show little or no respiratory change. The following tables show a comparison between normal individuals and those already suffering from tuberculosis or showing a predisposition thereto in relation to lung-mobility after forced inspiration and lung-resonance. Five cases have been selected at random for each group from a large number of persons examined. All measurements were made in the right middle axillary line.

NORMAL INDIVIDUALS.

Case.	Position of Lung Border.	Lung-mobility.	Lung-resonance.
1.........	Lower border, 7th rib.	6 cm.	Dull after forced expiration.
2.........	Upper border, 7th rib.	5 cm.	Dull after forced expiration.
3.........	Upper border, 7th rib.	4½ cm.	Flat after forced expiration.
4.........	Upper border, 8th rib.	5 cm.	Dull after expiration.
5.........	Lower border, 7th rib.	6 cm.	Flat after forced expiration.

ABNORMAL INDIVIDUALS.

Case.	Position of Lung Border.	Lung-mobility.	Resonance.
1. Tuberculosis, first stage.	Lower border, 9th rib.	¾ cm.	Pulmonary percussion sound the same during expiration as during inspiration.
2. Patient from a tuberculous family. Has chronic cough.	Upper border, 10th rib.	1½ cm.	No difference in percussion sound.
3. Tuberculous family history. Lungs poorly developed.	Upper border, 11th rib.	½ cm.	No difference.
4. Incipient tuberculosis.	Upper border, 9th rib.	2½ cm.	Slight dullness.
5. Patient has characteristic tuberculous physiognomy	Lower border, 10th rib.	1 cm.	No difference.

The following conclusions may be formulated: (1) In health the percussion note of the lungs is resonant during inspiration, and dull or even flat during forced expiration. (2) In emphysema the percussion note is unchanged during the two phases of respiration. (3) This unchanged percussion note, heretofore recognized in pulmonary vesicular emphysema, is pathognomonic of lungs predisposed to tuberculosis and of lungs already affected. (4) Associated with the unchanged percussion sound, there is an extension of the lung-borders, manifested by downward dislocation of the lung and diminution, often to the extent of obliteration, of the cardiac and splenic areas of absolute dullness. (5) Unchanged percussion resonance is indicative of deficient expiratory force of the pulmonary substance, and constitutes one of the earliest trustworthy signs of the so-called pretuberculous stage of tuberculosis.

The Lung Reflex.—Another interesting phenomenon[101] is what I have denominated the "lung reflex." It illustrates the important fact that the respiratory area may be influenced indirectly by stimuli acting on the vagi. Elsewhere I have shown the value of the lung reflex in diagnosis. Here I will only consider its relation to lung development. In a contribution by Mocucci the suggestion was made that when ether was sprayed over the left half of the abdomen, marked reduction in volume of the spleen was observed in twelve cases. In repeating the experiments I likewise noticed a decided reduction in the area of splenic dullness in all individuals on whom this method was tried, irrespective of the fact whether enlargement of the spleen existed or not. Investigations convinced me that this diminution in the area of splenic dullness was not real, but only apparent. When the ether-spray was directed over the region of the heart, the percussional area of that organ was reduced at once; in fact, the superficial area of cardiac dullness could be obliterated by the maneuver. Similarly, when the spray was directed over the hepatic region, the superficial area of dullness of that organ could be reduced at once. When the spray was directed over the border of the lungs posteriorly, the lung borders could be made to descend from two to four inches, dependent on certain conditions. It was further ascertained that dislocation of the lung-borders by forced inspiration never approached the dilatation of the lungs produced by the cutaneous application of the ether-spray. Further experiments demonstrated, in brief, the fact that the application of any cutaneous irritant, whether the latter be mechanic, chemic, or electric, would always induce acute dilatation of the lungs. Even in emphysematous individuals the application of a cutaneous irritant still further augmented the existing lung dilatation. The question naturally arose, by what means could we establish the fact that the application of any cutaneous irritant would cause acute dilatation of the lungs—a condition which, it may be mentioned parenthetically, is only of a few minutes' duration? Such a hypothesis was made tenable by the aid of conventional physical signs and the use of the fluoroscope. These aids show that when the skin is irritated by means of cold, by friction, or by a strong faradic current, lung dilatation will ensue. The degree of lung dilatation is dependent upon the character of the irritant and the severity of its application. The response of the lung to dilatation is always greatest in that part of the lung contiguous to the source of cutaneous irritation. Lung dilatation may be recognized by the following physical signs: (1) Diminished respiratory excursions of the lung-borders. (2) Extension of the pulmonary percussion note and obliteration of the cardiac and splenic areas of dullness. (3) Hyperresonance of the lungs. (4) Obliteration of the apex-beat. Auscultation is of no value as a physical sign, inasmuch as the artificial dilatation does not last longer than three minutes after the source of cutaneous irritation has been removed. Lung-dilatation spreads, from the source of cutaneous irritation involving primarily circumscribed parts. In lungs showing diminished resonance the latter could always be increased by cutaneous irritation over the part percussed. The x-rays show how the brightness of the lungs is increased by cutaneous irritation. By gradually applying the irritant to different parts of the skin of the thorax, one may note that eventually the entire lung may be made to yield a more intense luminosity. This increased luminosity, however, does not last longer than three minutes in the average person, after which time the lungs resume their normal appearance.

In a number of measurements made during the study of the lung reflex after cutaneous irritation, I found the average dislocation of the lower border of the lung as follows:

Right sternal line	3¼ cm.
Right parasternal line	3¼ cm.
Right mammillary line	4 cm.
Right axillary line	6 cm.*

In another communication I demonstrated that *acute dilatation of the lungs* can be invoked in healthy persons by irritation of the nasal mucosa, and, conversely, that this condition can be dissipated after removal of the source of irritation. The pulmonary neurosis of dilatation can be obtained by firmly compressing cotton in both nasal cavities. The degree of lung dilatation with its concomitant phenomena will naturally vary according to circumstances which modify other reflex acts. After the introduction of the cotton, a few moments elapse before percussional results are noted. One will then observe supperresonance and immobilization of the lung-borders and diminution of the areas of hepatic and cardiac dullness, in the latter instance, even to obliteration. Irritation of one nasal cavity with cotton does not yield manifest results. If the mucosa of both nasal cavities has been thoroughly cocainized before the introduction of the cotton, no lung dilatation ensues. I have frequently encountered, in my clientèle, individuals presenting the symptomatic picture of pulmonary vesicular emphysema in whom was associated some abnormity of the nose. The anomaly was a simple coryza, spurs, deflection of the septum, hypertrophic rhinitis, or polypi. At any rate, after eradication of the nasal anomaly the symptoms of pulmonary dilatation disappeared. The form of emphysema here cited is in reality an acute lung dilatation, an eradicable condition dissociated with the anatomico-pathologic conditions conventionally allied with emphysema. The typic clinical picture of acute lung dilatation could nearly always be made to disappear by aid of the *cocain test,* which constitutes in this form of pulmonary neurosis a diagnostic aid of unquestioned value. After applications of a solution of cocain to the nasal mucosa, the lung-borders will recede and the lung resonance and normal vesicular respiration are restored. In patients suffering from *asthma* of presumable nasal origin, impaction of cotton in one or both nasal cavities may induce a typic asthmatic paroxysm. This fact is of undoubted diagnostic value. I maintain that the phenomena of lung dilatation can be provoked at any point in the extensive course of distribution of the pneumogastric nerves, and that the stimuli may act indirectly on the vagi through the terminal fibers of the trigeminus, or, as already shown, by irritation of the cutaneous sensory nerves, contiguous to the lungs.

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* "*Atelectasis* may be differentiated from pleural effusion by forcible rubbing of the affected side, acting through the lung reflex of Albert Abrams, which clears up the percussion note" (Sir James Barr). Minerbi (Gazetta degli ospedali, Dec. 27, 1908), based on a study of 300 cases and 14 autopsies, regards an absence of the lung reflex at the apices posteriorly as one of the earliest and most trustworthy signs of pulmonary tuberculosis.

It is necessary to hypothesize the existence of two distinct functions of the vagus nerve, or, at any rate, different fibers, with two distinct functions: fibers which can dilate (bronchodilator nerves), and fibers which contract (bronchoconstrictor nerves), the lungs upon application of the appropriate stimuli. In the action of these two sets of nerve-fibers the vasoconstrictor and vasodilator nerves of the vasomotor system may be cited as analogous.

The Heart in Diseases of the Lungs, Especially in Tuberculosis.—I am firm in the conviction that the heart is an important factor to be considered in phthisiotherapy. In our intense struggle for specific remedies in tuberculosis of the lungs we have been unwise in disregarding this important organ. The consensus of opinion in phthisiotherapy now is to make the organism resistant to the desperate white plague, and unless we make the heart equal to the burden cast on it by tuberculous lung invasion, it is difficult to conceive how we can ever gain mastery over pulmonary tuberculosis. I have given especial attention to the behavior of the heart in the pretuberculous and the tuberculous stages, and I have been astounded with the results of my observations. In most of my cases it would appear as if the heart bore the brunt of the trouble, and not the lungs. In brief, treatment directed toward the maintenance of cardiac vigor by the rigorous employment of the Schott methods of baths and exercises wrought a phenomenal improvement in my tuberculous cases which had heretofore been impossible with other methods of treatment. It is the right heart which succumbs in tuberculosis, manifested by enfeebled heart-tones and dilatation of the right chambers. However effective the treatment of tuberculosis may be by means of forced nutrition and continuous open-air treatment, the vascular nutrition of the lungs must suffer if the vigor of the heart is not maintained.

It was Brehmer, I believe, who first vigorously defended the theory that the so-called tuberculous habitus was particularly characterized by a too voluminous lung associated with a very small heart. In his enthusiasm in support of his theory, Brehmer maintained that the disposition to and the cause of tuberculosis was a small, weak heart. The selection of the site for his sanatorium was influenced by his theory. Residents of high altitudes, he argued, enjoyed immunity from tuberculosis, because a high altitude, owing to the diminished air-pressure, increased the action of the heart, eventually inducing hypertrophy of that organ, which in itself excludes tuberculosis. Space forbids me to pursue further the brilliant ratiocination of Brehmer; suffice it to say that, like the proponents of all theories, he has pushed his views to extremes; yet, withal, there is a tithe of truth lurking in his doctrine. Clinicians are bound to recognize the heart as an important element in tuberculosis, and to pay to it the tribute which cardiotherapy demands.

The Heart in Asthma.—I believe that Kingscote[106] has measurably advanced our knowledge of the etiology of asthma. For some time I have carried out similar investigations, and am thus able to confirm many of his observations. While I am not convinced that a dilated heart is the essential cause of asthma in the majority of instances, yet I contend that a dilated heart is operative in predisposing to an asthmatic paroxysm and augmenting its severity. Giving expression to a conservative statement, I have no hesitancy in saying that since inaugurating the treatment of asthma by the Schott method, which has for its object the invigoration of the heart, my results have been better than by any other methods of treatment.

Methods of Respiratory Gymnastics.—In the discussion of this subject I will limit myself to the citation of only a few of the various methods of lung development. These are as follows: (1) By action on the cutaneous sensory nerves; (2) by forced voluntary breathing; (3) by developing the muscles of respiration; (4) by converting costal into diaphragmatic breathing and, conversely, diaphragmatic into costal breathing; (5) by eliminating a definite group of synergistic muscles concerned in inspiration.

1. *Action on the Cutaneous Sensory Nerves.*—Recalling the

brief reference made to the lung and heart reflexes, we know that these phenomena may be evoked by cutaneous stimulation. This can be best accomplished by cold water ablutions aided by vigorous friction. This stimulates the nerve-centers presiding over the functions of respiration, circulation, digestion, nutrition, and excretion. The flux and reflux of blood between the periphery and viscera are facilitated, and leukocytosis is produced. The stimulation of the respiratory center is greater through the cutaneous nerves than through the vagus branches to the respiratory organs. In animals which have been made apneic, cutaneous stimulation (cold water) induced strong respiratory movements. We must, therefore, regard cutaneous stimulation as a simple and powerful stimulant of the center of respiration.

2. *Forced Voluntary Breathing.*—I believe we are justified in protesting against prolix methods for securing lung development. Such methods accomplish little and defeat their object by their monotony, which causes them to be relinquished. I am a strong advocate of simple deep inspirations with forced expirations unaided by "breathing-tubes" or constrained postures. The Röntgen rays have furnished me with the indisputable proof that this method is correct. It is well known that the lungs in health appear in the fluoroscopic picture as light areas. The lungs appear brighter during inspiration than expiration; in fact, the greater the lung inflation, the brighter the reflex. I have examined patients with the fluoroscope during the time "breathing-tubes" were used, and while different postures and exercises were practised, as advocated by various writers. I was unable to demonstrate that any method was superior to that of forced breathing. In fact, in some of the advocated methods the fluoroscope demonstrated the lung-phase to be really that of expiration, whereas the object supposed to be attained was lung inflation. To enhance the value of forced inspiration with the object of attaining hyperventilation of the lungs, the simple expedient of holding the breath after full inspiration will be found of great value. After a little practice patients are able to hold the breath fully two minutes. If during this maneuver regional percussion is made, it will be found that the position of the lung-borders extends beyond the limits attained by forced inspiration alone. The principle in-

volved in explanation of the foregoing phenomenon is one relating to pneumatics—by raising the temperature of a gas we increase the volume. Another simple maneuver is to direct the patient, after taking a forced inspiration, to count slowly. With a little practice 80 can be counted without difficulty. This is an exercise both for the inspiratory and expiratory forces. For rapid lung development inhalation of compressed air by the aid of the pneumatic cabinet is unquestionably the best method. After a limited course of treatment the thoracic capacity may be increased 2 per cent., with a corresponding development both of chest measurements and chest expansion.

3. *Developing the Muscles of Respiration.*—I do not believe in exercises tending toward individual development of the thoracic muscles. Whatever the character of the exercise, it should include the general muscular system. While it is undoubtedly true that expansion of the lung is most evident when the movement of the overlying chest wall is most pronounced, it is equally true that overdevelopment of the thoracic musculature conduces to fixity of the chest. Feebly developed thoracic muscles do not indicate a diminished vital capacity, for, after all, chest-mobility is more easily influenced by expansibility of the lungs than by the action of the thoracic muscles. I have made many spirometric measurements, and find that when the thoracic muscles are excluded in the chest expansion, as far as possible, the spirometer shows results nearly as good as when they are actively engaged in lung expansion. Breathing exercises do not necessarily influence respiratory action directly. The results achieved are due, in the main, to the removal of peripheral resistance, thus increasing the arterial circulation, the relief of venous congestion owing to the increased quantity of blood in the arteries, and to diminished work of the heart owing to free circulation of blood in the arterial system. The heart is the mainstay of lung development. Like any other muscle, it owes its vigor to the activity of respiration. The exceptional muscular strength of insects is no doubt due to the fact that they respire from nearly every part of the body. Inordinate muscular exercise cripples the heart, while judicious exercise strengthens it. Whatever the nature of the muscular exercise, we must always bear in mind that the slightest evidence of dyspnea or palpitation is

a signal of danger and demands interdiction of the exercise. The ideal exercise, to my mind, is swimming, which conduces to equal development of the muscular system, limits the danger of overexertion, and secures the tonic influence of the water on the skin.

4. *Reversing the Type of Respiration.*—Thoracic enlargement is attained by elevation of the ribs and descent of the diaphragm. In ordinary breathing the respiration is chiefly abdominal and the rib movement is slight, especially in the upper chest. In women the type of respiration is reversed: diaphragmatic descent is inhibited, while the upper chest becomes more expanded and very mobile. It is within reason to regard the diaphragmatic breathing of man as well as the costal breathing of women as equally unnatural in certain instances of poor lung development. In women it is easy to develop the lower lung-regions by instituting dress reform, but in men the remedy must be sought in another direction. The type of breathing may easily be reversed by means of a rubber bandage. If, for instance, in women we wish to restrict the movements of the upper chest, we apply the bandage to the upper bony case, and, conversely, to the base of the chest when respiratory activity is to be encouraged in the upper part of the chest. The influence of such maneuvers calls forth excessive lung expansion, as may be seen in the accompanying illustrations. I need not at this time comment on the extraordinary possibilities of this simple method, which I have used for a length of time sufficient to demonstrate its value.

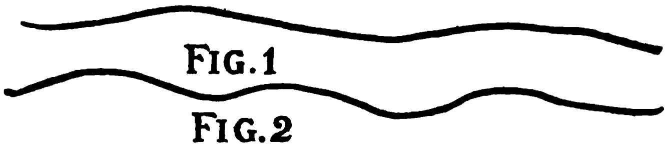

Fig. 62.—Stethographic tracings before (Fig. 1) and after (Fig. 2) application of the rubber bandage to the lower chest. In Fig. 2 there is exaggerated costal breathing with augmented respirations.

The stethographic tracings (Fig. 62) were taken over the upper chest, before and after the application of the rubber bandage to the lower chest. The individual from whom the tracings were taken showed very little chest mobility. The following tracings

(Fig. 63), taken directly from the fluoroscope, show the effects of bandaging on the position of the diaphragm. They illustrate more fully than words can describe the possibilities of the elastic bandage in influencing respiration in definite lung areas.

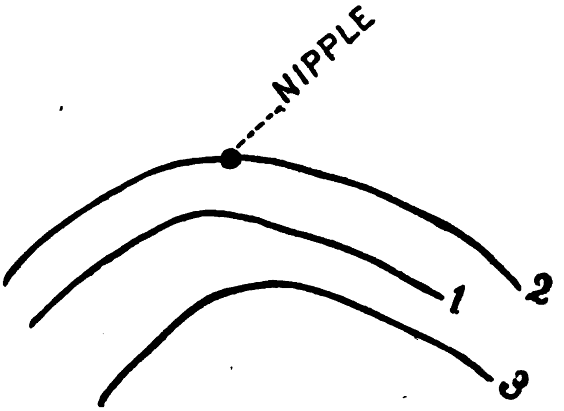

Fig. 63.—Position of the diaphragm after application of the rubber bandage. 1, Normal position; 2, position after application of the bandage to the abdomen and lower chest; 3, position after the bandage is wound around the upper chest.

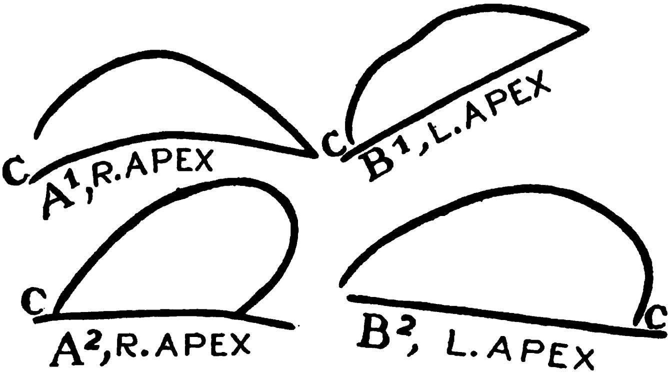

Fig. 64.—Tracings from the fluoroscope. Case of incipient tuberculosis; slight physical signs and hemoptysis; no tubercle bacilli in the sputum. *A*, 1, *B*, 1, Apices before application of the rubber bandage to the lower chest; *A*, 2, *B*, 2, apices after application of the bandage to the lower chest; ballooning of the left apex very marked; *C*, clavicle.

Figs. 64 and 65 show the ballooning effects of the apices consecutive to application of the rubber bandage to the lower chest.

They are tracings taken directly from the fluoroscope. The practical value of this maneuver is exemplified in tuberculosis implicating the apices when it is desired to concentrate the action of the compressed air. I owe much of my success in the treatment of tuberculosis to what I have called the ballooning process of aëro-therapeutics. We know that the parts adjacent to tuberculous infiltration represent the points of least resistance, and are therefore likely to become emphysematous. In developing an artificial local emphysema by this process, we are but anticipating nature. The good results achieved in tuberculosis by compressed air are essentially due to mechanic action, viz., dilatation of the collapsed lung, readmittance of air, and the expulsion of products due to retrograde metamorphoses.

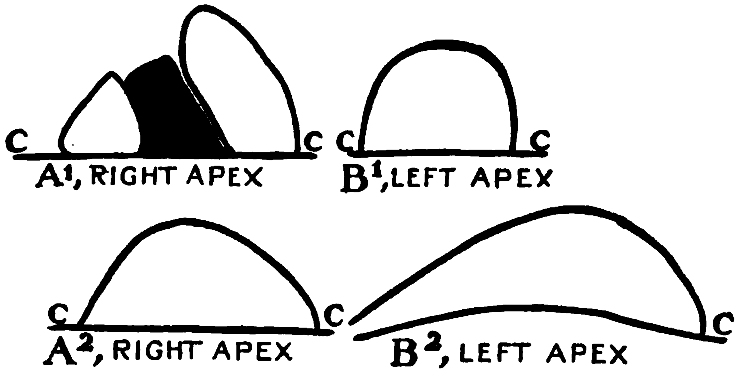

Fig. 65.—Tracings from the fluoroscope. *A*, 1, *B*, 1, Apices before the application of the rubber bandage to the lower chest; the right apex casts a distinct shadow in its middle; case of incipient tuberculosis; *A*, 2, *B*, 2, apices after application of the rubber bandage to the lower chest; ballooning of the left apex is specially pronounced; *C* in the cuts represents the clavicle.

Eliminating Groups of Synergistic Muscles.—Not infrequently we are called upon to eliminate certain muscle-groups for the purpose of evoking respiratory activity in lung areas. Here again we may have recourse to the rubber bandage or to the use of strips of adhesive plaster. The ordinary adhesive plaster is exceedingly irritating to the skin, and for this reason I use Johnson's zinc oxid adhesive plaster. The latter will be found unirritating and sufficiently adhesive for all practical purposes.

RESPIRATORY EXERCISES IN THE TREATMENT OF DISEASE.

Pulmonary Tuberculosis.—The greatest gift which the phthisiologist has conferred on medicine is recognition of the curability of tuberculosis. No disease in our nosology is more amenable to treatment. Its successful treatment postulates its early recognition. Manifold are the methods advocated for its early diagnosis, but one and all espouse the application of procrastinated signs for a disease already ingrafted on a soil propitious for its development. The development of lung tubercles is an advanced manifestation of tuberculosis. The time is fast approaching when the diagnosis of pulmonary tuberculosis will be made by the pathologist and not by the clinician. The time was when the presence of tubercle bacilli in the sputum constituted one of the earliest signs of tuberculosis, but in our present state of knowledge it must be regarded as a late sign. One really questions whether Koch's discovery of the tubercle bacillus has been of benefit to the phthisiotherapist, for it is true that the majority of physicians delay diagnosis, and consequently treatment, until the tubercle bacilli are demonstrated in the sputum. In the prebacillary period of tuberculosis scientific diagnoses may have been less frequent than now, but tuberculosis was more often treated at an earlier period in the disease, and if not successfully, it was because our modern hygienic methods were not then recognized. The portrayal of the physiognomy of tuberculosis, so marvelously described by Galen and Hippocrates, was to them good presumptive evidence of the disease—not a tendency to tuberculosis, but the disease itself. If reliance were more often reposed on the Hippocratic physiognomy than on the presence in the sputum of tubercle bacilli, then phthisis would be recognized, treated, and cured, and tuberculosis anticipated and prevented. The distinction here made between phthisis and pulmonary tuberculosis is purely an arbitrary one; it is the recognition by a clinician of a pulmonary condition preceding tuberculosis which the pathologist cannot hope to recognize. I would strongly urge the use of the terms phthisis and bacillary phthisis to designate respectively the pretuberculous and tuberculous stages of phthisis. The stages of phthisis adopted by the pathologist are strictly anatomic and are of no clinical value. In no other disease is the conflict between the clinician and the pathologist more in evidence. The latter strives to establish definite histologic anomalies, while the former should content himself with the recognition of functional anomalies. The service rendered to the clinician by the pathologist is incalculable, but it should not impose upon the former the penance of blind submission. The trend of my argument is in favor of the patient and not science. In all suspected cases of phthisis the patient is entitled to the benefits of the doubt, and should be regarded as phthisical unless proved otherwise. It is criminal to usurp the functions of the pathologist by waiting for the demonstration in the sputum of the tubercle bacilli. It is no reproach to the diagnostician if he suspects syphilis and treats the patient in accordance with the supposition. Is not the average physician remiss in the early recognition of phthisis? We circulate literature instructing the laity relative to the prevention of tuberculosis. Why not institute a crusade against physicians for their carelessness? Not more than 10 per cent. of the phthisical patients coming to me have ever had their sputum examined for tubercle bacilli, and not more than 20 per cent. have had a systematic examination made of their lungs. In this regard I make no mention of advanced methods of examination, such as the use of the Röntgen rays. Errors in diagnosis are not so much due to ignorance as to carelessness. The treatment of phthisis is based on hygienic methods which will benefit the sick and well alike. The tuberculin test* and the Röntgen rays are applicable only when structural changes in the lungs have followed functional anomalies, and therefore furnish late evidence of tuberculosis. Loomis, in an exhaustive and erudite paper, proceeds in the right direction when he strives to collect evidence of a vital condition which predisposes to the development of the tuberculous stage of phthisis. If this evidence were at the command of every physician and applied, a formidable preventive inoculation against phthisis would be effected. The correction of the chest conditions peculiar alone to the phthisically predisposed would be practically nothing else but vaccination against the disease. Such methods should be advocated with the same stringency as is inoculation against variola. Each school should have an attending physician who would incorporate this duty with his other functions. One of the signs recognized by Loomis as a symptom of the pretuberculous stage of phthisis is *chloranemia*, which is practically the condition of the blood to which reference has already been made, viz., pulmonary anemia. We must not forget that phthisis, like pneumonia, is a constitutional disease. In both affections the lungs are merely the stage on which the tragedy of somatic infection is played.

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* Reference has already been made (page 277) to the diagnostic value of tuberculin. A positive reaction with the subcutaneous method is obtained in 50 to 80 per cent. of clinically healthy individuals (Wolff-Eisner). According to the latter, the *conjunctival reaction* shows only active tuberculosis, whereas the cutaneous and subcutaneous methods demonstrate active and latent tuberculosis. A negative result with the conjunctival reaction in those manifestly tuberculous indicates an unfavorable prognosis.

The prevention and treatment of tuberculosis are best attained by the "open-air" treatment. Fresh air is a specific in tuberculosis. Its specificity is demonstrated with the same certainty as is mercury in syphilis and quinin in malaria. To give the patient merely a fresh-air environment suggests the privations of Tantalus; he must breathe it; it must enter every lung alveolus; such ventilation is equivalent to aseptic drainage. Bearing these facts in mind, we will no longer regard climate as that indefinite, mysterious, and subtle factor which is too often an accommodating haven for the physician's delinquencies when he wishes to transfer his proprietorship of the patient to death. Among the many reasons adduced why tuberculosis more frequently attacks the apices than any other part of the lungs, one above all others appeals to reason: viz., the apices move less on respiration than the other parts of the lungs. Now, any prolonged quiescence of a part destined by nature for activity necessarily represents the *locus minoris resistentiæ*. As an aid to pulmonary gymnastics of the apices, I would suggest the constant use of the rubber bandage encircling the lower chest.

Bronchitis.—Respiratory gymnastics are of undoubted value in this affection. There is no better expedient for dislodging accumulated secretions in the bronchial tree than forced voluntary inspiration and expiration. Such exercises also encourage the pulmonic circulation, which in itself is a decided step toward resolution.

Bronchopneumonia.—I have described elsewhere a variety of this affection, under the term *septic bronchopneumonia*, which gives practically the same clinical picture as is obtained in the second stage of tuberculosis, the only difference being that no tubercle bacilli are demonstrable in the sputa. If untreated, a case of septic bronchopneumonia soon becomes a case of pulmonary tuberculosis. There are, to my knowledge, only two ways of averting this calamity. The first is to trust to the *vis medicatrix naturæ*, which is usually in this affection not responsive to our desires; the second is to dislodge the unresolved exudate mechanically, by aid of compressed-air inhalations, with results which are immediate.

Bronchiectasis.—Inhalation of compressed air, which mechanically dislodges the stagnated sputa, is the only palliative measure of avail in these cases. I have treated many such patients, but have never cured them.

Asthma.—For asthma depending on bronchial catarrh, treatment of the latter by compressed-air inhalations is practically a specific. In true nervous asthma, the results with the same method of treatment are less encouraging. As an adjunct to other methods of treatment in asthma, I regard respiratory gymnastics as indispensable. I employ inhalations of compressed air. The objects which I hoped to achieve by so doing are to readjust the mechanism of the perturbed respiratory apparatus, and coincidently the heart, and to make the respiratory mucosa apathetic to the insults which provoke a paroxysm. My own experience does not tally with the results achieved by perhaps more acute observers, notably Campbell,[108] who, for instance, regards the effect of respiratory exercises as often little short of miraculous. It is well to remember that in asthma, as well as in emphysema, the costal type of breathing is only slightly manifest, most of the work being performed by the diaphragm. Here the application of the rubber bandage to restrict diaphragmatic breathing is indicated for the purpose of encouraging costal breathing. In the medicinal treatment of asthma we have much to hope from the observations of the rhinologist, who deals with a mucosa which in function is not unlike that lining the respiratory tree.

Emphysema.—This disease, when complicated with bronchitis, is very amenable to treatment by aid of compressed-air inhalations. Treated with the cabinet, the air within the cabinet is condensed with the act of exhalation. In this affection the difficulty in breathing is at the time of expiration. Theoretically, breathing compressed air would appear to aggravate the lung dilatation, but the contrary is often the case, as I have satisfied myself frequently. Deep inspirations increase the capacity of the pulmonic circulation, and thus diminishing the extra work thrown on the right heart, give almost immediate relief to the dyspnea so frequent in emphysema. There are two other methods of mechanic treatment which I would suggest as extremely serviceable: One method is to facilitate the defective expiratory force by wearing constantly the Martin elastic bandage, which encircles the chest in its entirety; and the other is by the transference of water (Fig. 66) from one bottle to another by aid of the expiratory effort of the patient. The bottles should hold a gallon of water each, and the arrangement of the tubes is similar to that in the Wolff's bottle. Osler[100] recommends this method for expanding the lung after withdrawal of the fluid in chronic pleurisy. I believe that the effect of such exercise is to promote collapse and not expansion of the lung; at any rate, skiascopy of the chest during the time this method of exercise is practised shows the lungs to be in a condition of expiration. Regional percussion also demonstrates retraction of the lung-borders. The same exercise is applicable in asthma, the lungs in the intervals of the paroxysms being in a partial emphysematous condition.

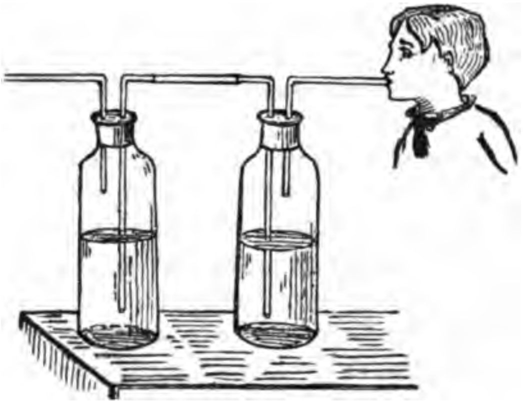

Fig. 66.—Arrangement of bottles for promoting lung contraction.

Pneumonia.—One of the most egregious errors committed by the internalist is to neglect the after-treatment of pneumonia. The treatment of croupous pneumonia prior to the crisis is admittedly expectant; its course being in no wise influenced by drugs. Lung consolidation after pneumonia may exist for months, owing to delayed resolution. The recognition of this condition is often difficult owing to persistent pleural thickening over the involved lung-area. It is unnecessary for me to point out the sequels of delayed resolution; the point to which I wish to direct attention is the importance of removing and facilitating the absorption of the exudate. Aside from the presumable existence of an exudate, the lungs after pneumonia are always crippled, and means tending toward restoration of the lung in either condition can only be effected by aid of aërotherapy.

Pleuritis.—In the acute form of this affection rest rather than exercise of the affected side is indicated. It is only when pleural exudates resist absorption that lung gymnastics are indicated. Experiments prove that when fluid is introduced into the pleural sac, artificial respiration will facilitate its absorption. I have seen pleural effusions which had resisted all methods of treatment, including repeated paracentesis, which only yielded to inhalations of compressed air in the pneumatic cabinet.

Ankylosis of the Lung.—I have employed this phrase to designate the formation of pleural adhesions from a previous pleuritis, approximating the visceral together with the lung to the parietal layer of the pleura, a condition analogous to the ankylosis which occurs in joints. Pleural adhesions are exceedingly common, and their presence leads to a group of symptoms of which pain and dyspnea, chiefly on exertion, are prominent. The objective diagnosis is difficult and is often solved only by treatment. Subject such individuals to a series of treatments with the cabinet or institute a course of lung exercises and one hears such expressions as, "I couldn't take such a deep breath for months," or, "I feel this side move, which it never did before."

Heart Disease.—Twelve years ago I urgently recommended pneumatic differentiation by means of the pneumatic cabinet as one of the most efficient agents then at our command in overcoming the symptoms of cardiac failure, especially those dependent on an embarrassed pulmonary circulation. In the absence of a cabinet, results nearly as good may be attained by breathing exercises systematically and persistently pursued under the same restrictions that govern the Schott resistance movements. So competent an authority as Quimby[111] avers, "There is no therapeutic measure (referring to valvular lesions) whose action is so definite or constant." The action of respiratory exercises in heart disease practically amounts to nothing more than the recognition of the fact "that pulmonary resistance is in inverse ratio to pulmonary capacity" (Campbell). The more completely the lungs are distended, the more capacious is the pulmonary vascular system, hence the less resistance to the right heart and diminution of its work. In conclusion, let me add that respiratory exercises have been highly extolled in the treatment of nervous and digestive disturbances, obesity, cholelithiasis, etc., but in such affections the personal equation as well as suggestion cannot wholly be disregarded in the elements of success.

The Vibrosuppressor.—Various methods have successively been employed for determining the borders of the heart, liver, and spleen, ranging all the way from auscultatory percussion to the latest claimant for favor in outlining the heart, the orthodiagraph. The successful use of the latter predicates extraordinary skill in its use, and even then it is condemned by some as untrustworthy. The technic of percussion is rapidly advancing to a state of desuetude, owing to the employment of the plessor and pleximeter. The latter can never supplant the *tactus eruditus* of the fingers. One skilled in percussion is aided in his results not so much by what he hears as by what he feels; in other words, the sense of resistance determined by palpatory percussion is paramount. The heart, liver, and spleen encroach on an atmosphere of resonance. Determination of the superficial area of dullness of the latter organs is illusory, insomuch as the most trivial cutaneous irritation provoked by percussion causes the lungs to dilate (lung reflex of Abrams) and thus diminish or obliterate the areas in question. If we percuss the normal chest, say beneath the clavicle, a sound is produced which is the product of the vibration of the lung tissue and the thoracic walls. It is the summation of this vibration which interferes with the elicitation of the dullness of the airless organs in juxtaposition to the lungs. If the vibration in question could be eliminated, the definition of the viscera would prove easy of attainment. Without entering into a discussion of the physics of the thoracic sounds, it will suffice to observe that the air contained in the lungs and the vibration of the sternum are the chief factors in producing what is known as lung resonance. The sternum is essentially a sounding-board. There are two methods of eliminating thoracic vibration: (1) Percussion of the organs after expression of the air from the lungs by forced expiration; (2) inhibiting the vibration of the thoracic walls, notably the vibration of the sternum. In executing the first method, we are too dependent on our subjects, many of whom are so undisciplined in lung gymnastics that they are unable to make any extraordinary efforts in expelling any reserve air from the lungs. In patients who are able to practise forced expiration, topographic percussion of the organs is a very simple matter if percussion is executed during the time no breathing is attempted after forced expiration. If the expiratory is used in connection with the second method, viz., vibratory suppression, then topographic percussion is made doubly easy. The second method will, however, suffice in the majority of instances. I have made control investigations with the *x*-rays and found that by its aid one can accurately define the borders of the heart; the left border of the organ, however, with less difficulty than the right border. The portable apparatus which I employ for this purpose has been called, for convenience, vibrosuppressor. It is a simple and inexpensive apparatus which was made under my directions by Verdin, of Paris. Fig. 67 represents the apparatus, which is modeled after a tourniquet, consisting of pelote, screw band (6 cm. wide), and clamp for fixing the latter. It is so applied that the pelote rests on the xiphoid cartilage of the sternum. The pelote must be made to compress the cartilage by aid of the screw with all the pressure the patient can tolerate. Percussion is then executed during the time the apparatus is employed, and, if possible, percussion should be aided during suspended respiration after forced expiration.

The vibrosuppressor aids in the definition of other thoracic areas of dullness, such as the dullness of aneurism, pleural exudates, etc. I want, however, to especially emphasize its great value in eliciting dullness in the lung apices in early phthisis. The experienced clinician knows, contrary to current opinion, that resonance and not dullness of the apices is the attribute of early phthisis. The reason for this, as I have endeavored to explain several times in the literature, is because the lungs are so voluminous, and consequently so resonant, that though dullness of the apex may be present, it is masked by the contiguous resonance of the lungs. The vibrosuppressor, however, I have found indispensable in the diagnosis of early phthisis. I sought to employ the vibrosuppressor for demarcation of the lower liver border by percussion, but to no purpose. The only method which I find accurate in defining the lower liver border is as follows: The patient is instructed to incline his body backward as far as possible; and to relieve the tedium of the posture, the body is supported by means of the hands resting on the hips. If percussion, which must be very light, is now attempted, the lower hepatic border is easily elicited. In the posture suggested we approximate the surface of the liver to the abdominal parietes, and afford a like medium for the transmission of the percussion sound: namely, the relatively dense abdominal

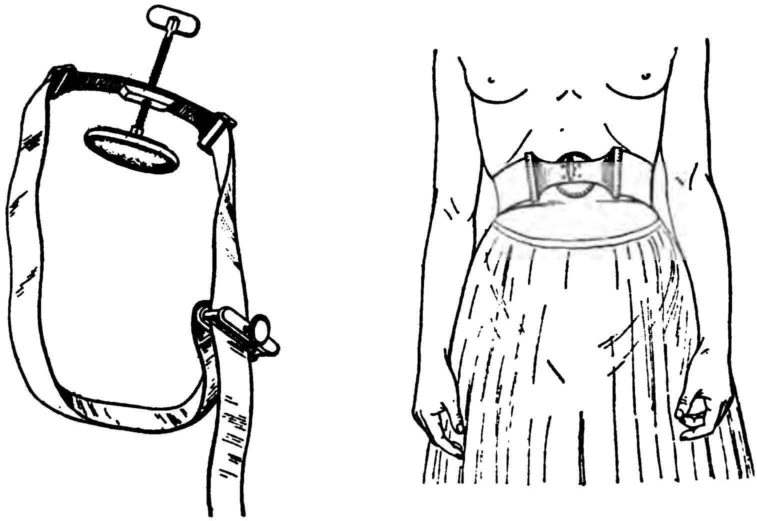
Fig. 67.—The vibrosuppressor and the method of its application.

musculature. This method is based on a simple law of physics, that sound-waves are best conducted by the medium in which they are produced. The percussion sound in the conventional method of eliciting the lower liver-border must pass through the abdominal muscles, and then through the air-containing viscera, before it reaches the liver.

In the absence of a vibrosuppressor, firm pressure made on the lower end of the sternum by the hand of an assistant will aid topographic percussion. It is also advisable to execute percussion when breathing is suspended after forced expiration. Attention may here be directed to the *threshold percussion* of Goldscheider[328]: A rubber cap of a medicine-dropper is fitted over the end of a straight or bent glass rod, as preferred. The covered end of the rod is placed against the chest wall, the end resting in the intercostal spaces, the rod at an angle with the chest-wall, but parallel with the boundary that is to be percussed. The rod is tapped lightly with the finger at some distance from the proximal end. The advantages of this procedure are said to be many, but notable is the one that a very small area can be percussed at one time, and that the instrument can be placed in the intercostal spaces. The percussion note is clear and distinct, and the boundaries of an organ, especially the heart or liver, can be outlined readily. The percussion is done in the mid-respiratory position, and then the patient is told to inspire slowly. The dorsal position of the patient is preferred.

Changes in the Position of the Lung-borders.—Forced inspiration will obliterate a greater part of the superficial area of cardiac dullness. Friction of the skin over the cardiac region, by causing the lung to dilate (lung reflex), will bring about the same result. In pericardial effusion the area of dullness is not reduced either by deep inspiration or by the lung reflex. During deep inspiration the lower border of the lung descends, and ascends during expiration (active mobility). During deep inspiration when the patient is lying on the side, the lung may descend as much as 3½ inches. The dislocation of the lower lung-border is greatest in the axillary line. The dislocation upward during forced expiration is slightly less than the dislocation during inspiration.

During quiet breathing the difference in the position of the lower lung border is not more than ½ inch. Passive mobility is noted when the position of the patient is changed. In the recumbent, the lower lung-border descends about ½ inch lower than in the erect posture. When lying on the side, passive mobility is greatest. Active and passive mobility are decreased in emphysema and pleuritis and absent when the lung-border is adherent. The foregoing facts may be ascertained by percussion.

The Intercostal Phonation Phenomenon.—Diagnosis is made up of such a multitude of little things that nothing, however insignificant, can be ignored. This refers with all cogency to the diagnosis of chest-diseases, for, notwithstanding our vaunted progress in the diagnosis of such affections, our conventional methods, notwithstanding their faithful execution, leave much to be desired. A recent method of diagnosis suggested by Stiller,[113] the intercostal phonation phenomenon, is observed in lean individuals. It consists of a distinct elevation of the intercostal spaces when short words or syllables are uttered by the patient. The wider the intercostal spaces (and the latter are widest between the axillary and parasternal lines), the more evident the phenomenon. The phenomenon is especially distinct where the respiratory excursions of the lungs are greatest, viz., in the lower thorax. Weiz first described the phenomenon in question, but his explanation of its genesis was incorrect. It is caused by waves of air, which in the moment of phonation when the glottis is narrowed, are carried in all directions down the bronchial tree to the region of the lung contiguous to the intercostal spaces, causing these to bulge. The pressure is also exerted on the relaxed diaphragm, causing it momentarily to descend, which descension is manifested by slight protrusion of the epigastric angle, which may be observed even in obese individuals. In individuals in whom the bulging is not clearly manifest the phenomenon may be detected by palpation. The practical value of this phenomenon in diagnosis, as suggested by Stiller, is the ability to determine the boundary between the lung and the liver or spleen, and to recognize the existence of a pleural exudate or transudate and to differentiate the latter from a pulmonary infiltration or lung tumor, if this is necessary. If fluid is present in the pleural space, the sudden increased pressure in the lung during phonation excites in the contiguous fluid push-waves, which bulge the intercostal spaces; thus the dullness of a pleural exudate can be differentiated from the dullness caused by lung infiltration or tumor of the lung. This phenomenon also permits of an accurate demarcation of the liver or spleen from the fluid in the pleural cavity. The writer has carefully studied the phonation phenomenon in a large number of cases, and he finds that it is best elicited if during phonation the patient closes his nostrils and places his other hand over his mouth, so that the expired air is partially obstructed in its exit from the lungs. Again, the patient should be instructed to practise forced expiration before phonation is attempted. For determining the line of demarcation between the lung and the liver or the lung and the spleen, the phonation phenomenon can never substitute careful percussion. Its real value lies in differentiating lung infiltrations from accumulations in the pleural cavity, and even here one cannot regard the phenomenon as infallible, insomuch as it cannot be determined in obese persons, when the exudate is so large that it compresses the lung or when pleural thickening and adhesions exist.

The Litten Phenomenon.—This procedure, suggested by Litten[114] in 1892, renders visible the diaphragmatic movements. The most detailed description of this maneuver may be found in the admirable text-book of Cabot[115] and in the third edition of Sahli.[116] To elicit the Litten phenomenon, or phrenic shadow, as it is also called, the patient lies upon his back with exposed chest and the feet directed toward a window. Cross-light must be eliminated by darkening other windows in the room. If the patient's bed cannot be placed in proper position with relation to the window, or if the observation is to be made at night, Cabot suggests using a strong light held at the foot of the bed, excluding all other lights. The observer stands at the patient's side, or stands a few feet from the patient with his back to the window and observes the lower chest at an angle of 45 degrees. The observer then directs the patient to take a deep breath, and as the ribs rise with each inspiration, a short narrow shadow moves along the axilla from about the seventh to about the ninth or tenth rib. The shadow is less evident during expiration, as it ascends to the point from which it started. In ordinary breathing the shadow in its descent occupies one to one and a half and in forced inspiration, two to three intercostal spaces. The shadow line cuts the ribs at an oblique angle. The phrenic shadow can be observed on both sides of the chest, and not infrequently in the epigastrium. It is best observed in lean individuals of either sex, and is never absent in health unless the individual is very obese or cannot be made to take deep breaths. In normal persons, during ordinary breathing, the shadow excursion is about 2½ inches; whereas in forced breathing it is 3½ inches. The diaphragm phenomenon is easily explained, if reference is made to the accompanying figure (Fig. 68). At the end of expiration the diaphragm lies flat against the chest from its attachment up to about the sixth rib, but during inspiration it "peels off" as it descends and permits the lung edge to come down into the space between the diaphragm and the chest-wall. The "peeling off" of the midriff and the descent of the lung during the inspiration cause the moving shadow. The phrenic shadow is of undoubted clinical value and enables us to dispense with the Röntgen rays in many of our examinations. First of all, the phrenic shadow permits us to say that in that particular chest region the diaphragm and the lung lie in contact with the thoracic wall, and that both are freely movable. Its absence would suggest an opposite condition of things. In pneumonia of the lower lobe, pleural effusion, pneumothorax, and pleural adhesions, no shadow can be obtained. In

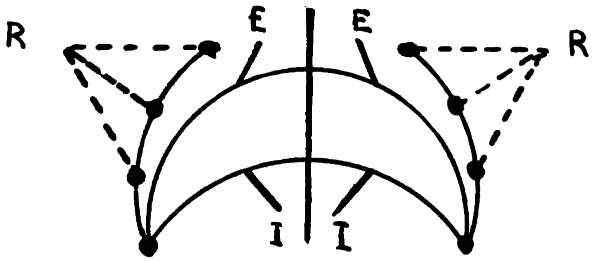

Fig. 68.—Excursions of the diaphragm during forced inspiration: *R*, Ribs; *E*, position of the diaphragm at the end of expiration; *I*, position of the diaphragm at the end of inspiration.

all the preceding conditions the diaphragm is displaced from the chest-wall, so that its excursions communicate no shadow. In advanced emphysema the shadow is diminished or lost, and the prognosis in this affection is gaged almost as effectually by the excursions of the shadow as by the spirometer, and the epigrammatic utterance of Lermoyez[117] seems apposite, that in emphysema "the ear makes the diagnosis, but the spirometer makes the prognosis." In the differential diagnosis between empyema and a subphrenic abscess, the presence or absence of the phrenic shadow may be of service; in the former affection it is absent; in the latter it is present, however feebly expressed. Partial adhesions between the diaphragm and the chest-wall are often recognized by an irregularity in the otherwise straight shadow. It has also been suggested that the phrenic shadow may be enlisted in differentiating a pneumothorax from a diaphragmatic hernia. The shadow is also of undoubted service in gaging the progress toward recovery of certain affections of the respiratory apparatus. In phthisis all writers are now agreed that limited diaphragmatic excursions constitute one of the earliest signs of the disease. It was Williams,[118] of Boston, who was probably the first to give prominence to this sign. The writer has shown elsewhere[119] that the condition is associated with hyperdistention of the lung, which, practically speaking, is naught else but a lung-emphysema. Clinicians have long recognized, notably West,[120] that in certain general diseases, in which the lungs are not otherwise affected, there is a loss of tone or tension in both lungs. The condition has been comparable to tympanites. The term pneumoparesis is not applicable to the condition, as it implies an involvement of the vasomotor nerves. The *Aufblähung* of the Germans or *volumen pulmonum auctum* is more suggestive of the lung condition. All this, however, is a mere theoretic discussion of the condition of the lungs in phthisis, for the clinical picture tallies in the main with that of emphysema.

Summarizing our knowledge of the movements of the diaphragm as influenced pathologically and determined by the phrenic shadow the following table is submitted:

SYNOPTIC TABLE OF THE PHRENIC SHADOWS.

THE PHRENIC SHADOW.	DISEASE OF THE LUNGS.	DISEASE OF THE PLEURA.	DISEASE OF THE DIAPHRAGM.	GENERAL DISEASE.
It is diminished...	1. Bronchitis (usually on both sides). 2. Emphysema (both sides). 3. Tuberculosis on both sides, especially affected side. 4. Abscess of lung (on affected side). 5. Asthma (interparoxysmal period). 6. Atelectasis. 7. Bronchopneumonia. 8. Lung congestion.	1. Pleuritic adhesions on affected side and the shadow is irregular. 2. Pleuritis (on the affected side).	1. Subphrenic abscess.	Myogenic causes: 1. Debility. 2. Anemia. Mechanic causes: 1. Pericardial effusion. 2. Cardiac enlargement. 3. Pregnancy. 4. Ascites. 5. Distention of stomach or intestines. 6. Abdominal growths. 7. Enlargement of liver. Inhibitory causes: 1. Peritonitis. 2. Pericarditis (acute).
It is absent.......	1. Pneumonia (on affected side). 2. Advanced emphysema. 3. Asthma (during paroxysm).	1. Hydrothorax. 2. Pneumothorax. 3. Empyema. 4. Pleural thickening. 5. Pleuritic adhesions (extensive). 6. Diaphragmatic pleuritis.	1. Spasm of diaphragm. 2. Paralysis of the diaphragm.	In the foregoing conditions when pronounced.
It is increased	On the unaffected side when, in consequence of disease, there is difficulty in respiration; the increased shadow is then purely complementary or compensatory.			

It must be conceded that careful percussion affords in most instances a trustworthy gage of lung mobility, but in every instance, all things being equal, the eye is a more reliable guide than the ear. An ocular demonstration of the phrenic shadow constitutes one of the most picturesque signs in clinical medicine. One reason why the phrenic shadow has not been brought more frequently into use is on account of the inconvenience necessary for its elicitation. The writer employs the sign constantly in diffuse daylight without special reference to the position of the patient. Used after this manner, it offers none of the inconveniences of the conventional clinical method. It is true that the uninitiated may, at first, experience some difficulty in its elicitation after this manner, yet, when once mastered, its recognition is easy. If the patient is in bed, it is more convenient to pursue the conventional method, but if the patient is an ambulatory one, he is placed with his back to the window, while the observer is seated at his side. The patient stands with arm extended above the head, while the other arm supports the side. The position of the observer is not constant, and it may be necessary for him to view the axillary region at different angles. The patient is then instructed to practise forced inspiration, but this exaction is often more difficult than the actual demonstration of the shadow. If he will not take a deep breath, ask him to cough or to suspend respiration for a time, or even make some violent exertion, maneuvers which will bring into play augmented midriff-action. If the shadow is recognized, it may be followed to a surprising distance around the chest, and this fact alone suggests the advantage of viewing it in diffuse light. It is better, however, that those who have never seen the phenomenon should seek for it after the conventional manner, and then attempt its elicitation after the method here recorded. Another advantage of demonstrating the shadow in diffuse daylight is evidenced by the fact that it can be seen on both sides at the same time, so that any discrepancy in the shadow becomes at once manifest. The patient stands, as before, with his back to the window, while the observer sits a few steps away with his back to the window. The patient now being instructed to practise forced inspiration, the observer notes a punctated retraction of the lower thorax on either side, beginning usually in the scapular line, but not infrequently in the posterior axillary line, followed by a shadow which descends and ascends in the intercostal spaces. The patient's arms are extended above the head and the body is inclined slightly backward, as if to relax the muscles of the back. This mode of attitude is necessary to obtain the best results. The writer has sought to exaggerate the shadow by different means, and he finds that if the skin is colored yellow over the area described by the excursion of the diaphragm, the shadow picture is much intensified. For this purpose the skin may be colored with picric acid solution, or, better still, a saturated alcoholic solution of gamboge may be used, as it is readily removed by means of alcohol. If neither of these agents is at command, anointing the skin with yellow vaselin will suffice. This coloring of the skin will also intensify the shadow when the conventional Litten method is executed.*

In concluding our examination after the manner just cited we must not be unmindful of the fact that the phrenic shadow can be confounded with two other manifestations, which likewise produce shadows, viz., the expiratory sinking of the lower ribs and the inspiratory retraction of the lower intercostal spaces. The former is an expiratory, whereas the phrenic shadow is an inspiratory depression. Inspiratory retraction of the intercostal spaces is more likely to be confused with the phrenic shadow. In the former, however, the shadow is diffuse, whereas in the latter it is linear, and the line can be seen to descend during inspiration, to ascend again during expiration.

Pleural Friction Sound.—In the average patient the recognition of the pleural friction sound is not difficult, although its acoustic impression is subject to great variation. It is frequently difficult, and often impossible, to distinguish it from a râle, and this difficulty is especially enhanced when pleural friction sounds and râles coexist. In the differential diagnosis the following points are usually recognized:

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* The writer has found that if the skin embracing the area of the test to be observed is made taut by grasping a fold of the skin, an intensification of the phrenic shadow results to a degree almost as great as when the skin is colored. Care must be exercised in not drawing the skin too tight, for otherwise respiration will become embarrassed and the shadow correspondingly diminished. Forced respiration through the mouth instead of through the nose intensifies the shadow many times. The author has found that firm pressure upon the abdomen with the hand will also exaggerate the phrenic shadow.

1. Râles are continuous; friction sounds, a series of interrupted jerks.

2. Coughing changes the character of râles, while friction sounds are not influenced.

3. Râles are diffused, friction sounds confined to a limited area.

4. Pressure with the stethoscope increases the loudness of the friction sounds, whereas râles are uninfluenced by the same maneuver.

5. Friction sounds are superficial and increased by forced inspiration.

The loudness of the pleuritic friction sound varies. In not a few instances even the trained ear will not detect it. In other instances it is audible at some distance from the chest. Cases are on record in which the sounds have been heard by the patient, and their intensity interfered with sleep. Very loud friction sounds are manifested by palpation (pleural fremitus). Pressure with the stethoscope, by approximating the pleural layers artificially, intensifies the sounds. Deep and accelerated respiratory movements will accomplish the same result, although, after a varying period of time, such forced respirations, by smoothing both pleuræ, cause the temporary disappearance of the friction sounds. If the respiratory excursions of the affected breast are superficial as a result of pain, or retarded in consequence of a hepatized lung (as in fibrinous pleuropneumonia), the pleural friction sounds are not always audible by auscultation. The pleural friction sounds are usually heard during inspiration, or during inspiration and the early part of expiration. At times they are only heard at the height of inspiration, and least often only during expiration. All these modifications are dependent on the fact that the inspiratory force of the respiratory movements is decidedly more vigorous than that of expiration. Laennec taught that the friction sound is conducted in definite directions. During inspiration the sound is conducted from above downward, while during expiration it is conducted in the reverse direction. This clinical fact is in accord with the physiologic movements of the lungs.

If, in a rabbit, the costal pleura is sufficiently exposed to enable the experimenter to observe the movements of the underlying lung, one observes that during inspiration the pleura glides in the direction from above downward and from behind forward. In the dislocation from above downward, the lung apex represents almost a fixed point. The diffusion of the pleuritic friction sound is usually limited. It is most diffused in the lateral, and least diffused in the upper region of the thorax. The conditions for the generation of the friction sounds are more favorable as we recede from the lung hilus, for the reason that the excursions of the pleural layers become more and more pronounced. Rarely are the friction sounds to be heard over the apices of the lungs, because the latter enlarge more by centrifugal distention than by dislocation. The duration of a friction sound varies. As a rule, it gradually becomes less loud as forced respirations are continued, eventually disappearing for a variable period of time. When any rhonchi and friction sounds coexist, the latter are not heard, owing to the loudness of the former. In such instances the inhalation of amyl nitrite has frequently afforded me signal service in differential diagnosis. Bronchospasm is commonly associated with the dry rhonchi; in fact, many of the auscultatory phenomena are dependent on the coexistent bronchospasm. Amyl nitrite by inhalation will cause the disappearance of the dry râles, leaving the friction sounds uninfluenced. Bruen[128] directs attention to the value of making the chest immovable. When the chest is fixed, especially at the lower two-thirds, by the hands of an assistant, and the stethoscope is applied over the doubtful sounds, they will be found to have disappeared if of pleural origin, but to be still present if râles. He further suggests that the patient should incline to the side opposite to that diseased, and place the hand of the affected side to the head; this puts the pleura in a state of tension, and will often obliterate a friction râle. My experience with this method of diagnosis has been limited, although in nearly every instance in which it was applied it has proved unsatisfactory. There are three maneuvers which I believe to be original with me in eliciting the pleuritic friction sound, and which make a differentiation of the latter from endopulmonary sounds possible. They are, in order of importance, as follows: (1) The arm maneuver. (2) The decubital maneuver. (3) Pressure in an intercostal space. Before describing these methods, I wish, at the outset, to emphasize the errors which may arise in the employment of the very soft rubber tip of our stethoscope in the auscultation of the finer acoustic phenomena of the thorax. Some time ago I was in the same predicament as the hapless wight of Holmes, who for the first time had employed a stethoscope. In a succession of individuals whom I examined in the course of several days, I dictated to my amanuensis for record in my case-book the presence of crepitant râles in nearly every patient examined. Investigation speedily demonstrated the error of my observations. It was found that the slightest shifting in the position of the rubber tip of my stethoscope, owing to the excursions of the thoracic parietes in breathing, would yield a sound not unlike the crepitant râles of the pleuritic friction sound. This error was especially manifest when the skin of the thorax was moist. No maneuver, whether it was drying of the skin or rubbing it with alcohol, was successful in obviating the error. The only expedient which was really successful was to keep the pectoral end of the stethoscope fixed, although, even here, one had to eliminate the noises produced by the rubber in fixing it to the chest. Since this occurrence, whenever supposed crepitant râles were auscultated, I confirmed the observation by auscultating with the buttoned rod of my phonendoscope.

The Arm Maneuver.—The patient suspends respiration after full inspiration, after ordinary breathing, or at the end of expiration. Then the arm on the affected side is raised while in extension, either by the patient, if intelligent, or otherwise by the physician, until it reaches the side of the head. The movement described corresponds to the Sylvester method of artificial respiration. During the time the arm-excursions are made the suspected area is auscultated. By the arm maneuver the movement of the parietal against the visceral pleura is opposite in direction to that occurring during the respiratory act, and for this reason the pleuritic sound may often be elicited after the sound has been exhausted in the ordinary act of breathing. It soon exhausts itself, like the pleuritic friction sound elicited in the conventional way. In obtaining the friction sound after this method, care must be exercised lest the patient breathe. The sound thus obtained can only emanate from the pleura, and this fact alone establishes its value in differential diagnosis. The elicitation of the pleuritic friction sound by this method is less constant than its development by forced inspiration. It is heard most often when respiration is suspended after deep inspiration, and least often after forced expiration.

The Decubital Maneuver.—Let the patient lie on the affected side for one or two minutes; then direct him to rise quickly and suspend respiration. Now auscultate the affected area, at the same time directing the patient to take a deep breath. If pleuritic friction sounds are present they will be greatly intensified or be made to appear, when not detected in the usual manner. One error is likely to suggest itself by this method, and that is, the creation of atelectatic crepitation. In almost any individual atelectatic crepitation may be induced by the same maneuver. If, however, the lungs have been fully expanded, prior to the execution of the decubital maneuver, and the lateral posture is only of short duration, the danger of misinterpretation will be reduced to a minimum. A little experience soon enables one to pick out the characteristics of atelectatic crepitation and make confusion with pleural sounds impossible. This method is based on the fact that the position adopted by the patient approximates the two layers of the pleura, or, to use a homely though suggestive phrase, sticks one layer of the pleura to the other.

Pressure in an Intercostal Space.—Pressure with the stethoscope usually intensifies the friction sound. As employed ordinarily, pressure is made on the ribs. If, however, pressure is made in an intercostal space, and not on the rib, we can more certainly approximate the costal to the visceral pleura, the actual principle on which this method rests. To carry out this method successfully, the arm on the side to be auscultated is first raised; this act materially widens the intercostal spaces. In the intercostal space over the region to be auscultated we place the buttoned rod of the phonendoscope. Experience has taught me that the phonendoscope is not adapted to this method, for the reason that when the patient is instructed to take a deep breath while pressure is exerted with the rod in the intercostal space, adventitious sounds are created with the phonendoscope which interfere with correct auscultation. To obviate the latter difficulty, and it is a great one, I use the buttoned rod of the phonendoscope in association with my stethoscope. Fitted around the hard-rubber bell of my stethoscope and covering its mouth is a piece of tin, in the center of which is screwed the buttoned rod of the phonendoscope. The button at the end of the rod may be easily molded after slight heating in a flame to make it narrower so that it will easily fit into an intercostal space. The latter fact is of especial importance in the case of children, in whom the intercostal spaces are decidedly less wide than in adults. The accompanying illustration (Fig. 69) shows the phonendoscopic attachment, which may be fitted into any stethoscope.

The posture of the patient will aid in the elicitation of the friction sound. Thus, if the patient lies on the unaffected side, the lung on the implicated side makes greater respiratory excursions, and in consequence brings the pleural layers in apposition.

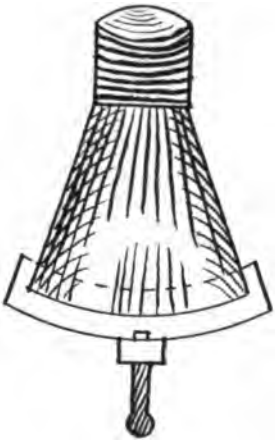

Fig. 69.—Phonendoscopic attachment to the ordinary stethoscope for the intercostal auscultation of friction sounds.

Subclavian Murmurs.—Some time ago a patient was referred to me by a colleague for an examination of his heart. The patient in question had been rejected by a life insurance company on the ground that he was suffering from an incurable valvular lesion of the heart. A physical examination demonstrated that the cardiac tones were marked by murmurs which had their seat of maximum intensity in the left fossa of Mohrenheim, that depression under the clavicle in the outer part of the infraclavicular region between the pectoralis major and deltoid muscles. There was nothing in the objective examination to indicate a cardiac anomaly, yet here was an instance where a subclavian had been misinterpreted for a cardiac murmur. I know of instances where the diagnosis of aneurism of the thoracic aorta had been made for no other reason than the mere demonstration of a subclavian murmur.

The case of the rejected life insurance applicant suggested an investigation of the subclavian murmur. The literature on the subject was found to be meager and indefinite. The following essential facts were gleaned. Subclavian murmurs are sounds heard over the subclavian artery which are dependent on the phases of respiration. They are usually best heard at the height of inspiration, less often at the end of expiration. When very intense, they may be recognized by the finger as *frémissement*. They are heard more often on the left than on the right side, rarely on both sides, and least often on the right side. English practitioners of medicine have been especially prominent in the study of the phenomenon, and have regarded it as a clinical sign of pulmonary tuberculosis when it is only manifest on one side. This opinion was combated by Fuller and Palmer. The former found the subclavian murmur twelve times among one hundred healthy persons; whereas Palmer found it to exist thirty-seven times among one hundred and twenty-nine healthy laborers.

Mechanism of the Subclavian Murmur.—The mechanism of its origin has not been made definite, although it has been variously attributed to compression of the subclavian artery by the elevation of the first rib in inspiration or to the action of the subclavius and scaleni muscles. Friedreich observed the subclavian murmur most frequently among phthisical individuals, and suggested as a cause the occurrence of adhesions between the vessel wall and the lung pleura, which led to a narrowing of the artery in one or both phases of respiration. He contended that, insomuch as pleural adhesions were not infrequent, even among healthy persons, he was constrained to conclude that such adhesions sufficed to explain all subclavian murmurs, the extent and direction of the synechiæ determining the occurrence of the murmur during inspiration or expiration. From an examination of more than three hundred persons, I am able to formulate the following conclusions:

1. The subclavian arterial murmur is an independent (autochthon) and rarely a transmitted murmur.

2. Its point of maximum intensity is the fossa of Mohrenheim, with feeble tendency to propagation.

3. It is heard most often on the left side, less frequently on both sides, and least frequently on the right side. In order of frequency it is heard at the height of inspiration, at the end of expiration, and after momentary suspension of respiration.

4. It is usually a succession of murmurs uniform in character

and intensified by certain maneuvers, notably deep inspiration, forced expiration, suspension of respiration, and voluntary stretching of the neck.

5. One of the chief characteristics is its momentary duration, disappearing usually after a few deep inspirations.

6. Its dependence on the phases of respiration distinguishes it from all transmitted murmurs.

7. It may be present at one and absent at a subsequent examination, and neither its character nor duration is ever uniform from one examination to another.

8. The position of the patient may influence its genesis, but this is never sufficiently uniform to be of practical value.

9. A phthisical lung is not specially propitious to its occurrence, as it is found nearly as often in healthy as in phthisical persons.

10. It was present in 36 per cent. of all healthy persons examined, advantage being taken in this enumeration of re-examinations and those propitious factors which determine its occurrence, *viz.*, respiration and decubitus.

11. The venous subclavian murmur was only heard in six individuals with a preponderance of its occurrence on the right side.

12. The arterial subclavian murmur could be artificially induced on the left side in nearly 80 per cent. of all individuals examined, and on the right side in about 65 per cent. of the cases by a simple maneuver, viz., raising the arm gradually until it assumes a vertical position, while auscultating the Mohrenheim fossa during the time that the arm is brought to the latter position, the murmur suddenly appearing at some time during the execution of the movement.

13. By the foregoing maneuver the subclavian venous murmur could be induced on the right side in 43 per cent. of all persons examined.

Anatomic Conditions.—To explain the origin of the subclavian, arterial, and venous murmurs, a short excursion into the realms of anatomy is necessary. The right subclavian artery arises from the arteria innominata, whereas the same vessel on the left side arises from the end of the transverse portion of the arch of the aorta. The left subclavian artery is longer than the right and directed almost vertically upward, instead of arching outward, like the vessel of the opposite side. The inner aspects of the upper lobes of both lungs are occupied by grooves, one on each side, for the subclavian vessels, where they are invested by the pleura. The third portion of each subclavian artery rests on the outer surface of the first rib, and at the lower border of this bone becomes the axillary artery. The points in connection with the first rib that suggest attention are the tubercle and ridge, which serve for the attachment of the scalenus anticus muscle, the groove in front of it transmitting the subclavian vein, that behind it the subclavian artery. Both subclavian veins, which are the continuation of the axillary veins, unite with the internal jugulars to form the right and left vena innominata. If we auscultate the subclavian artery, we hear, in the majority of cases, just as we do in listening over the carotid, two clear tones, one corresponding with the filling of the vessel, the diastolic, and the other with the emptying of the vessel, the systolic tone. Less often only one tone is heard, which is usually coincident with the systole of the blood-vessel. The tones thus heard are the transmitted first and second aortic tones. If we press moderately with the stethoscope, let us say, the carotid artery, we hear a pressure-murmur corresponding to the arterial pulse; by stronger pressure, which almost, but not quite, closes the artery, this murmur is changed into a tone, the so-called pressure-tone. With these preliminary facts at our disposal, we can make explicable the subclavian murmur as heard in health. The following facts demand solution:

1. Why is the subclavian murmur heard loudest during forced inspiration and expiration?
2. Why is the murmur of short duration, disappearing after a few deep inspirations?
3. Why is the murmur heard more often on the left than on the right side?

Factors Necessary For Its Production.—The essential factor necessary in the production of the subclavian murmur is a moderate narrowing of the lumen of the blood-vessel. The recorded frequency of the subclavian murmur in phthisis, and its explanation that pleural adhesions are responsible for its occurrence, is in a measure untenable, for such a condition presumes a narrowing of the blood-vessel that would be persistent at some phase of the respiratory act. My observations show that the murmur occurring in phthisis is just as transitory as it is in health. Moderate narrowing of the subclavian artery occurs during forced inspiration. This is a fact which is easily demonstrable in almost any individual by palpation of the radial pulse. In not a few instances deep inspiration will cause the radial pulse, especially the left, to disappear. The paradoxic pulse has lost much of its clinical significance as a diagnostic aid in mediastino-pericarditis, since observations have shown that in health distinct respiratory changes in the pulse are demonstrable by means of the sphygmograph. The sphygmogram shows a fall in the pulse-curve during inspiration and a rise during expiration. Deep, prolonged inspiration, by elevating the first rib, effects compression of the subclavian artery, which accounts for the murmur, which is really a pressure-murmur. Violent contraction of the muscles of inspiration or forced contraction of the muscles which draw the shoulder forward while the arm is at the side will change the murmur into a tone—the pressure-tone. The occurrence of the murmur only during expiration may be explained in part by the fact that after the artery is excessively compressed by the act of inspiration, this pressure is in part removed during the beginning of expiration, which act converts a pressure-tone into a pressure-murmur. Then again the blood-pressure must be taken into account during the expiratory act. Stretching of the neck, which will sometimes elicit the murmur, is explained by the action of the scalenus medius elevating the first rib. The short duration of the murmur finds explanation in the artificial production of the pressure-murmur in the normal artery. Here, as in the normal artery, the ever-increasing narrowing of the lumen of the subclavian artery will convert a murmur into a tone. This is practically what occurs during forced inspiration, for a murmur heard during the beginning of the inspiratory act may no longer be audible at the end of that act. Then again attention must be directed to a condition which Kernig and myself have described, viz., a complete dullness of the lung apices without any structural change in the lung. In many healthy persons this condition is manifest. It is not difficult to conceive that the subclavian artery would be more effectually compressed by an atelectatic upper lung-lobe than by an aërated lobe. After a few deep inspirations the subclavian murmur is no longer evident, owing, perhaps, to the fact that the apices becoming more aërated offer less resistance to the superimposed arteries. The more frequent occurrence of the murmur on the left side finds facile explanation in the anatomic differences between the two arteries; the left reacting more easily than the right subclavian artery to the influence of those factors which conduce to compression of the blood-vessels.

Means by which the Murmur may be Elicited.—The method I have advocated for eliciting the subclavian murmur is simple. Placing the pectoral end of our stethoscope in the fossa of Mohrenheim, we listen for the subclavian murmur. If the latter is not heard, we slowly raise the arm of the patient corresponding to the side auscultated until it is audible. The murmur may not be demonstrable until the arm is elevated to a level with the shoulder or until it assumes a vertical position. This maneuver evokes the subclavian phenomenon by narrowing the lumen of the subclavian artery, for coincident with the elevation of the arm the radial pulse becomes less and less evident, until, when the arm has attained the vertical position, the pulse is no longer palpable. This diminution in the pulse-volume is more manifest on the left than on the right side. In a certain percentage of persons examined the maneuver of raising the arm gave rise to a subclavian venous instead of an arterial murmur, while in other persons both murmurs were distinctly audible. The soft, musical, continuous hum of the venous murmur cannot be confounded with the arterial murmur. Like the artificial venous murmurs produced by pressure of one of the large veins by means of our stethoscope, so may the subclavian venous murmur be explained, viz., that by raising the arm we elevate the first rib, which in turn narrows the subclavian vein. The more frequent occurrence of the subclavian venous murmur on the right side is explained in the same way as we explain the increased frequency of the jugular venous murmur on the same side.

Influence of Breathing on Cardiac Murmurs.—Endocardial murmurs are less intense during forced inspiration because the heart is more completely covered by lung during this phase of respiration. Hence murmurs are best studied after forced expiration with temporary suspension of respiration. Pericardial murmurs are increased in intensity during inspiration because the lung approximates the layers of the pericardium. Endocardial murmurs by the same act are, as already remarked, diminished in intensity because the interposed lung offers a poor medium of conduction to the chest-wall. Pleuro-pericardial murmurs often simulate pericardial murmurs. They arise when the pleura or peritoneum adjacent to the heart is roughened. They are modified by respiratory movement, disappearing or diminishing when breathing is suspended or disappearing after forced expiration. Deep inspiration will usually accentuate them. Cardio-respiratory murmurs are sounds synchronous with the heart's action, produced outside this organ and heard usually to the left of the apex-beat. Two factors enter into the production of these murmurs: (1) Forcible expulsion of air from the lung by the heart striking against it; (2) with each cardiac contraction the bulk of the heart is reduced in size and a corresponding vacuum produced in the chest, which the lung compensates by expanding, thus producing a murmur. These murmurs are not heard if auscultation is practised after forced expiration. Cardiopneumatic râles have the same origin and are occasionally heard in bronchial catarrh.

Pulsus Paradoxus.—If the aorta is stretched or narrowed by connective-tissue adhesions dependent on a pericarditis or mediastinitis, one notes by palpation of the pulse, or better by means of the sphygmograph, a decided reduction of the pulse during each inspiration, and if the latter is deep, the pulse may disappear. If the adhesions involve the superior vena cava or large venous trunks, there is inspiratory swelling of the jugular veins. *Thoracic pains*, notably shoulder pains, are increased by breathing when tuberculosis of the apex of the lung is present. In such instances one may suspect secondary neuritis of the brachial plexus, which shows increased sensitiveness on pressure. Retrosternal pain intensified by deep breathing is suggestive of aortitis (traction on the vessel). The pain of peritoneal adhesions of the abdominal viscera is intensified by abdominal breathing, and in such instances respiration assumes the costal type.

Abdominal Tumors.—Gastric tumors, as a rule, are but slightly movable with respiration. Renal tumors, as a rule, do not move with respiration. Tumors of the liver and spleen are characterized by their mobility with respiration, and if these organs are enlarged, they are best palpated during a forced inspiration. A movable kidney may often be grasped at the height of inspiration. Rigidity of the abdominal wall is best determined by noting whether it moves with respiration.

Cardiac Inhibition.[182]—The inhibitory nerve of the heart is the vagus, stimulation of which stops the heart in diastole. Czermak was able to press his vagus nerve against a little bony tumor in the neck, and by thus subjecting the nerve to mechanical stimulation was able to slow or even stop the beating of his own heart. If, in almost any healthy person, the carotid artery, or a point immediately adjacent to it in the neck, is compressed, slowing or complete inhibition of the heart and pulse ensues. This phenomenon is explained by compression of the vagus lying alongside the carotid artery. Friedreich, and subsequently Sewell, of Denver, observed that strong pressure with the stethoscope on the chest could cause the disappearance of murmurs, especially in individuals with an elastic thorax, which was attributed to inhibition of the heart movements.

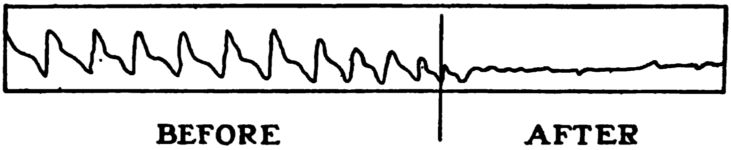

Fig. 70.—Sphygmogram showing pulse-tracing before and during the maneuver for provoking inhibition of the heart.

I have endeavored to employ the phenomenon of cardiac inhibition as an aid in diagnosis. Observation has taught me that, for clinical purposes, inhibition of the heart is best attained by forcible voluntary contraction of the muscles of the neck. In some instances the inhibitory effect on the heart is best observed when the head is stretched backward, and, when in this position, contraction of the neck muscles is attempted. With some persons, to whom no instructions are intelligible, I place a long narrow cushion on the front of the neck, and then ask them to press with all their might on the cushion with their chin. If too much violence is used in any of these maneuvers, the primary effect will be to increase the rapidity of the heart. If the maneuver is properly executed, we diminish the intensity of cardiac tones and murmurs, and it is this fact that determines the real value of cardiac inhibition in diagnosis. A few seconds usually elapse before the effect on the heart becomes manifest, then, while the subject is still forcibly contracting the muscles of the neck, the heart-tones become less and less evident, assuming an embryocardial character, until finally they are no longer audible. The accompanying sphygmogram (Fig. 70) was obtained from an individual on whom the method was tried for the first time.

We note almost total annihilation of the pulse after irritation of the vagus by the contracted neck muscles. My investigations with this maneuver may in brief be summarized as follows:

1. Organic heart-murmurs will become faint and often inaudible.
2. Transmitted murmurs are more amenable to the maneuver.
3. The fainter the murmur, the more easily it is suppressed.
4. When a transmitted murmur can be inhibited, the tone which it masks can be auscultated.
5. Heart-tones are less amenable than murmurs to inhibition.
6. Hemic murmurs are more readily inhibited than organic murmurs.
7. When the murmurs of anemia are inhibited, they are replaced by tones.
8. Incorrect execution of the maneuver will intensify rather than diminish murmurs.
9. The inhibition maneuver, when too often repeated, is futile in its results owing to over-stimulation of the vagi.
10. The maneuver enables us to determine the condition of the vagi as inhibitors of the heart and guides us in the administration of cardio-tonics.

Illustrative Cases.—The value of the method is illustrated by the following cases:

1. Murmur audible during diastole in the second right interspace. At apex, systolic tone and diastolic murmur. During inhibition the murmur in the second right interspace becomes fainter, while the diastolic murmur of the apex disappears and is

replaced by a tone. Diagnosis: Aortic incompetency. The diastolic murmur at the apex is a transmitted murmur.

2. Loud murmur, audible during diastole, in the second right interspace. At the apex systolic murmur and diastolic tone. During inhibition: Murmurs over aorta and apex persist, but are less loud. Diagnosis: Aortic and mitral incompetency. The systolic murmur at the apex is not transmitted but is dependent on mitral incompetency.

3. Systolic murmurs over all the ostia and not transmitted away from the heart. Blood evidence of anemia. Inhibition: Systolic murmurs replaced by systolic tones. Diagnosis: Murmurs of anemia.

4. Systolic and diastolic murmurs at base of heart, modified by pressure with stethoscope and position of patient. Anemia not present. Inhibition: Murmurs disappear and replaced by tones. Diagnosis: Pericardial murmurs.

5. Murmur at fourth left interspace. Heart irregular and rapid. No anemia nor sign of pericarditis. Inhibition: Murmur disappears, to be replaced by a tone. Diagnosis: Cardio-muscular murmur.

More recently I have found that abdominal pressure (Fig. 1) will likewise inhibit cardiac action, and the maneuver in question is available in diagnosis. With the same object in view pressure may be made on some point at the side of the upper dorsal vertebræ (*vide* vibratory massage).

Discipline of the Respiratory Rhythm.—Normally expiration succeeds inspiration without a pause. Inspiration is shorter than expiration, in the ratio of 5 to 6. In *hysteria* one of the most frequent respiratory manifestations is an exaggeration of the deeper breath, which is normally taken at every fifth or sixth inspiration. Then there is also the "catching" breathing, likened to the condition observed when cold water is suddenly thrown on the body. The breathing may be quickened (polypnea) or retarded (bradypnea). The hysterical cough is also a frequent symptom and occurs paroxysmally in young girls. One knows that at well-regulated sanatoria one rarely hears a cough. Patients may be disciplined to inhibit a cough. Dettweiler informs his patients that to cough in public is as much a breach of etiquette as to scratch one's head when it itches.

Pershing[124] refers to his method of controlling hysterical attacks, which are exaggerated emotional disturbances whose motor reaction is largely in the voluntary muscles, especially those of respiration. If the patient observes the first premonition of the attack, she will note that respiration is becoming rapid, shallow, and jerky. Now, by sheer force of will the respirations can be made slow and regular. When the latter is accomplished, then attention is directed to the contracted voluntary muscles, which must be voluntarily relaxed, and then the breathing is attended to again. Pershing remarks that the faithful performance of these instructions will arrest any ordinary attack, especially if reassurance in adults or the promise of reward in children be skilfully combined.

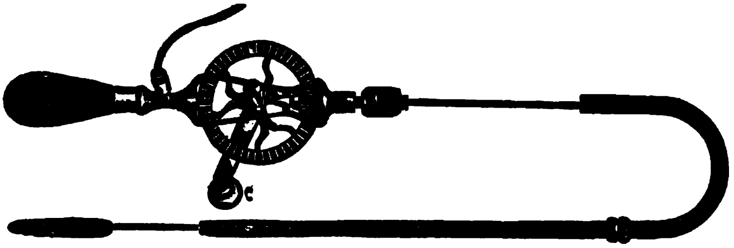

Fig. 71.—Turck's gyromele.

GYROMELE.

This instrument, invented by Turck, consists of a revolving sound, to the distal extremity of which a piece of sponge is fastened for removing viscid mucus from the walls of the stomach in gastric catarrh. The instrument is introduced into the stomach with as little difficulty as the ordinary stomach-tube. When an assistant turns the crank (*c*, Fig. 71), the sponge passes first along the greater and then the lesser curvature of the stomach. The course of the sponge can be very distinctly palpated from the outside by the physician, and is thus a very reliable means for determining the boundaries of the stomach. I have frequently made use of the instrument, in association with the *x*-rays, for locating the position of the stomach, and always with good results.

HELIOTHERAPY.*

Tuberculous laryngitis is rarely difficult of diagnosis when associated with pronounced signs of pulmonary disease. In the earlier stages of the affection the infiltrated or ulcerated areas must be differentiated from syphilitic and lupoid affections and

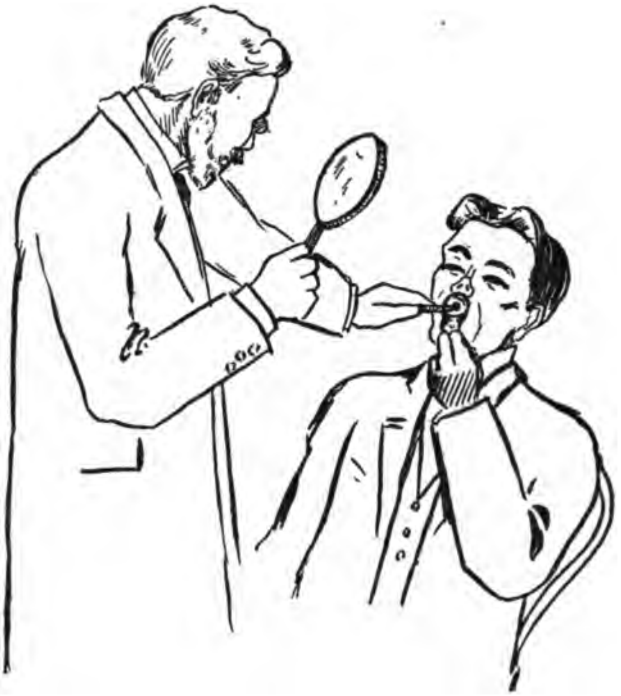

Fig. 72.—Method of employing the solar rays in laryngeal tuberculosis. The rays are concentrated by aid of a large lens (5 inches in diameter) directly on to a laryngeal mirror held in the left hand of the physician. The patient holds the protruded tongue. The eyes of the physician should be protected by dark-colored glasses. The caustic effect of the rays must be excluded, as they are only employed for their bactericidal action.

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* The treatment of laryngeal tuberculosis by means of the solar rays is accredited to Sorgo, although I suggested the same method of treatment many years in advance of the latter, and published the results in "The Philadelphia Medical Journal," March, 1899.

from benign and malignant new-growths. In the earlier stages of laryngeal phthisis the solar rays thrown into the larynx (Fig. 72) are almost specific in their action, and thus by their curative effects aid in differential diagnosis. The solar rays are directed on to a laryngeal mirror by means of a large lens. Treatment is given daily, for thirty or more minutes. The good results are manifested in a few days. Kunwald and Sorgo also report excellent results. In thirteen of Kunwald's cases infiltration and ulceration disappeared after a few séances.

I have reported excellent results in other local tuberculous affections, notably of the skin, and again emphasize that the solar rays must be employed for their bactericidal rather than for their cauterant action. The rays are assisted in their penetration by thoroughly anointing the area to be acted upon by means of vaselin, after which a subcutaneous injection is made of distilled water. Singer concludes from an extensive experience with the use of sun-baths in tuberculosis that they are of diagnostic and prognostic value, and the deeper the pigmentation following exposure to the solar rays, the more likely will a patient improve or become cured.

It is stated that those suffering from malaria can bring on a chill by sitting in the sun.

Vaccination under red light to exclude the chemic rays or wearing a red bandage alone is milder than when done ordinarily.

Freckles may be prevented on the face by the wearing of a red or brown veil, insomuch as they develop from the action of the actinic and not the heat rays of light.

If iodin is painted on the skin in the dark, only red light (photograph lantern) being employed, and the part covered to prevent the action of white light, absorption is rapid, and there will be neither discoloration nor blistering, even under prolonged use (Brunton).

HYDROTHERAPY.

Water acts upon the human organism by its physical and mechanic effects. Circulation, respiration, tissue-change, and heat-production are influenced by the application of water. Thayer demonstrated that the blood after a cold bath in typhoid fever contained three times the number of leukocytes than were present previous to the bath. This change is attributable to the increased activity of the circulation. Cold, by increasing the muscular tone of the vessels, increases tension, while warmth, by causing passive dilatation and loss of tone, relaxes. Strasser has shown that cold applications increase the alkalinity of the blood, which in turn augments the bactericidal properties of the serum.

Baruch's Sign.—If a bath of 75° F. is given for fifteen minutes with friction, and there is no abatement of the rectal temperature, it is pathognomonic of typhoid fever. The temperature after is compared with the temperature taken before the bath. Marchand[184] determines the prognosis of typhoid fever as follows: Baths at a temperature of 78° F. were given for fifteen minutes, and the temperature was taken in the axilla twenty minutes after each bath. When the temperature was reduced by 2.4° F., all the patients succumbed to the disease, whereas in patients who recovered, the reduction in temperature never exceeded 0.72° F. In the latter cases, notwithstanding the severity of the symptoms, the slight reduction in temperature indicated a favorable prognosis.

In *scarlatina* observations at the clinic of Prof. Filatow show that if the temperature only falls 0.2° C. after cold packs, the patient invariably dies; a drop of more than 1.5° C. indicates a favorable prognosis.

J. H. Kellogg, in a personal communication, has noted the interesting fact that any hydrotherapeutic procedure inducing cutaneous stimulation will occasionally in a *syphilitic subject* cause the appearance of a roseola eruption. Such an eruption may occur even though symptoms of syphilis have been absent for years. Individuals who have recently taken mercury may develop symptoms of salivation after the same hydropathic treatment. Kraus has noted the same fact, and regards a course of hydrotherapy as sometimes extremely valuable for revealing a latent syphilis, either in the primary or secondary stage. It is well known that during a course of hydrotherapy latent malaria may be brought into activity. Very often in secondary syphilis the cutaneous manifestations may be barely perceptible, and to bring the eruption more rapidly into evidence, I subject the patient to a hot-water or vapor-bath. This maneuver is equally applicable in other exanthemata. Strasser[125] observes that all painful *sensations in the heart-region* are influenced by cold and hot applications; that pains of inflammatory origin are beneficially influenced by cold, and spasmodic pains by cold as well as hot applications. He employs the applications in question as a means of differential diagnosis. He assumes that in degeneration of the cardiac muscle, the application of cold, say an ice-bag, will not produce a diminished area of cardiac dullness, as occurs with a normal myocardium; on the contrary, the area of dullness may increase. The pulse in such cases becomes more rapid and the symptoms of insufficiency, if present, become accentuated. If pain is associated with the cardiac lesion, it is intensified. On the contrary, warm applications influence such pains more favorably.

W. Gilman Thompson[292] attempts to show that the ordinary means of applying local heat and cold to the surface fail to affect the temperature of structures lying beneath the skin to any practical extent, so long as the peripheral circulation remains active. In consequence of his experiments, he suggests that the ice-bag may have purely a psychic effect. Evidently the author in question ignores the value of cold to the skin as an important reflex factor in the treatment of disease.

My attention has frequently been directed to an insufficient myocardium in individuals who fail to react to their matutinal cold bath. One understands a reaction in hydrotherapy to consist of warmth of the peripheral parts due to secondary dilatation of the vessels after exposure to cold water.

In *arteriosclerosis* hydropathic treatment is a valuable procedure in reducing blood-pressure. Thus it is that in this affection many symptoms dependent on spasm of the arteries, which is an invariable concomitant of this affection, yield to warm douches and packs. Müller found that baths below 92° to 104° F. produced first a slight rise of pressure, then a fall, followed later by another rise. Baths at a temperature of 104° F. and upward increased the pulse and raised pressure. Vapor baths and hot-air baths at a temperature of 122° F. and upward occasioned a rise in pressure and pulse-rate. Water baths at a temperature below that of the body (98.6° F.) slowed the pulse. Baths at a higher temperature increased the pulse.*

When *tachycardia* is of nervous origin, the application of cold to the nucha is of greater service than the direct application of cold to the precordia.

In *obesity*, according to Kellogg, the hot bath will increase oxidation to the extent of one ounce of fat in fifty minutes. The cold bath will do the same. In diabetes the cold bath will burn up an ounce of sugar in twenty-five minutes. The hot bath will do the same, though less safely.

Pfeiffer employs thermal bath cures for the purpose of differentiating *gout* from rheumatism. He shows that after a few thermal baths at Wiesbaden, the gouty individual may develop an acute attack of gout, or the rheumatic an acute paroxysm of rheumatism. In all instances pains of rheumatic or gouty origin are primarily intensified; thus he differentiates the pains of tabes and many joint-affections which are neither gouty nor rheumatic. The reaction (pains) in rheumatism does not occur until after the sixth or seventh bath, whereas in gout it usually follows the third bath. Perhaps the employment of ordinary hot-water baths (above 98° F.) would afford us the same aid in diagnosis.

It has been observed that heat relieves the pain of inflammation, but increases that of *suppuration*. It is also stated that when pain is of a congestive character, it is relieved by cold, but that pain of a neuralgic character is relieved by heat. One of the best means of conveying heat to a part is by the use of a hot poultice; hot fomentations are equally effective.

In many *neuroses of the stomach* the patient is unable to appreciate the difference between hot and cold water, and this is especially the case in hysteria. In the latter affection the anesthesia of the gastric mucosa may be absolute or a paradoxic condition may be present in which cold may create the sensation of heat and *vice versâ*. In testing the sensibility of the gastric mucosa to heat and cold, it is better to use a stomach-tube, so that the influence of the esophagus may be excluded. Pollatschek recommends the preliminary application of cataplasms to the abdomen to soften it, and thus facilitate abdominal palpation. The moist heat acts like a warm bath in relaxing the muscles.

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* *Hypertension* may be transient (vasomotor in origin) or permanent (angiosclerosis). If, after a warm bath of about an hour's duration there is no fall of blood-pressure, angiosclerosis may be assumed to be present.

Ptosis of the colon may be detected in intelligent patients by high rectal injections of water with a temperature of about 41° C. (106° F.). Differences of temperature are experienced by a patient only when the intestine approximates the anterior wall of the abdomen. When about a pint of the water enters, a sensation of warmth is felt over the symphysis (the water has entered the sigmoid flexure); the injection of another pint (more in women) enters the transverse colon, and, if the sensation of warmth is experienced above the navel, there is no ptosis. It is only when the latter sensation is felt below the navel, that the diagnosis of coloptosis is warranted.

Hot Sponge Test.—This consists of passing down the spine a sponge wrung out in warm water. The latter must only be sufficiently warm as not to be unpleasant to the healthy skin. In definite affections, notably in myelitis, pain is experienced by the patient when the sponge passes over the site of the disease.

Insomnia dependent on cold feet may be prevented by employing a hot-water bag.

Prof. Alfred Zobel, of San Francisco, directed my attention to a frequent cause of *constipation*—rigidity of the anal sphincter and diminished abdominal pressure from above. Here an enema of cold water quickly relieves the condition and promptly rules out other etiologic factors.

The application of an ice-bag to the precordial area, with the object of maintaining cardiac vigor, acts by virtue of the *heart reflex*. The latter, like every other reflex, may be exhausted, hence intermittent rather than continuous application of the bag is indicated.

The use of an ice-bag may freeze the subcutaneous adipose tissue and the condition may simulate a phlegmon.

HYPEREMIA TREATMENT.

Bier's treatment is based on the observation that hyperemia, like many other symptoms of disease, is not undesirable; on the contrary, occurring with the regularity of a natural law, it is nature's own remedy. Among the effects of hyperemia are: relief of pain, bactericidal action, resorption property of dissolving blood-coagula, exudates in joints and tendons, keloids, etc. The technic in affections of the joints is to apply an elastic bandage above the seat of the disease. It must be put on sufficiently tight to interfere with the venous return, but must not diminish the arterial flow, and in acute cases the pressure must be very light. The pulse below the bandage should be easily felt and the limb should be warm. Relief of pain is a test of the degree of tightness. Within a few minutes the limb begins to swell and the skin assumes a fiery red color up to the bandage. When the edema is well established, serum escapes from any wound which may be present. Severe cases should be treated in bed. In severe cases congestion is maintained for twenty-two out of the twenty-four hours, and this is gradually diminished to from eight to ten hours. The position of the bandage is changed after it has been ten hours in one place. In the intervals of relaxation the limb is raised to facilitate absorption. One of the greatest

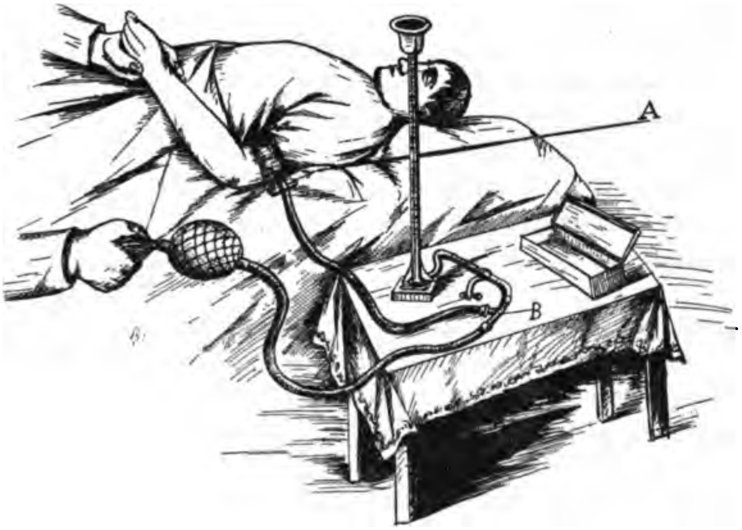

Fig. 73.—Method of employing the sphygmomanometer to control the degree of hyperemia (after Wilson).

difficulties in the application of the bandage in the hyperemic treatment of Bier is the estimation of the correct degree of tension. Wilson suggests the following ingenious method, which may be left to a nurse. After taking the blood-pressure it is allowed to fall 5 or 10 mm. below systolic pressure, when the screw-cock at *A* (Fig. 73) is tightened and the apparatus disconnected at *B*, leaving the inflated bag about the arm or thigh. A passive hyperemia can be attained with a pressure of 10 mm. or less, thereby fulfilling the indications of Bier: viz., that there should be warmth, cyanosis, and enlargement, but no pain, blanching, or coldness below the bandage.

Diagnosis.—Improvement is noted by diminished pain, improved pulse, and temperature-fall. The decline of fever occurs quickly when the cause is dependent on the absorption of poison from the inflamed area.

The use of the bandage is especially applicable in gonorrheal arthritis. Within one hour after the proper application of a rubber bandage the pain, according to Bier, will diminish and finally cease. In this affection stasis is practically a specific. In the cure of these cases stasis must be continued from twenty to twenty-two hours, until a profuse edema of the limb occurs. Not infrequently the bandage produces pain, and must be removed temporarily for about an hour, but usually the pain ceases on the advent of the edema. Elastic constriction is without value in gout and syphilitic joint-affections and is harmful in the presence of malignant tumors. It is often of value in acute and chronic rheumatism.

Kuhn suggests a mask of light celluloid with an adjustable valve which shuts off some of the air entering through the mask, which induces a condition of suction hyperemia. This mask he has found useful in *anemia*, and when the blood does not improve, he concludes that the anemia is of complicated and serious origin. Polano[330] applies artificial hyperemia by way of the mammæ in the treatment of *dysmenorrhea.* A few days before the menstrual period a suction glass is applied to each breast, and the glass is left in place for thirty minutes (removed and replaced during this time). The procedure is repeated daily, and continued until the last day of the period. Excellent results are reported.

HYPODERMOCLYSIS.

The subcutaneous injection of salt solution has all the advantages and none of the disadvantages of transfusion. One knows that the vascular system, when fully dilated, is capable of holding many times the quantity of blood contained in the body. Hypodermoclysis not only supplies fluid to the vessels, but it also acts directly and indirectly by stimulating vascular tension and cardiac activity. One must not inject a greater quantity of liquid than one dram to each pound of body-weight in each fifteen minutes. If this quantity is exceeded, the kidneys cannot excrete rapidly enough and the tissues become inundated. The solution used for injection is a decinormal salt solution (0.6 per cent.) because it corresponds (isotonic) to the blood-serum in saline strength, and this is important to prevent changes in the blood-corpuscles. One may also prepare the solution by adding to a quart of water a heaping teaspoonful of salt, and after boiling and filtering, the solution is ready for use. A glass irrigating apparatus is used with a rubber, to the distal end of which a large needle is attached. The reservoir hangs about two feet above the level at which the needle is inserted. The temperature of the solution in the reservoir should be about 110° F.

Diagnosis.—The kidneys eliminate 46 per cent. of our excretions, as against 5 to 9 per cent. by the feces. Clinical observations have taught that subcutaneous infusions will wash toxic products out of the blood-stream and will also dilute them. Many of the symptoms of acute infectious diseases, nervous and mental diseases, owe their origin to the accumulation of toxic products in the blood, and when such poisons are eliminated by hypodermoclysis, the nature of the symptoms is revealed. Thus, in the intoxication peculiar to the typhoid state, this injection acts as an antipyretic and a diuretic. In renal affections, when it is desirable to determine how far certain symptoms are dependent on defective elimination, hypodermoclysis may be valuable in diagnosis. The symptoms in anemia are not always relieved by martial preparations, because anemia is usually regarded as a diminution in the number of cells to the unit of volume, and no account is taken of the diminution in the quantity of blood as a whole. Here hypodermoclysis may be indicated.

INFLATION.

Ear.—The middle ear may be inflated: (1) By the Valsalva method, (2) Politzer's method, (3) catheterization.

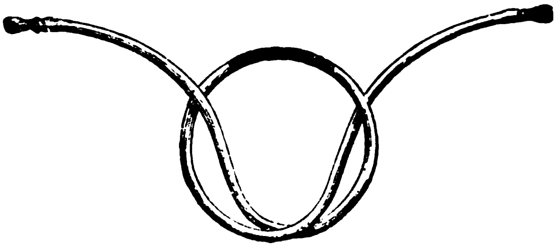

Fig. 74.—Auscultation-tube for the ear.

The third method is a delicate one and requires considerable skill.

The Valsalva method consists in compressing the air in the nasopharynx by forcing it up from the lungs when the nostrils are compressed by the thumb and fingers. With this and the other methods, an auscultation-tube is used which consists (Fig. 74) of a rubber tube with ear-attachments, one of which is placed in the ear of the physician and the other in the patient's ear.

The Politzer method dispenses with the catheter and is usually employed. One uses a rubber Politzer bag which is connected with a rubber tube about 8 inches long, to the end of which is attached an olive-shaped end-piece (Fig. 75). The end-piece is placed in one naris and both nasal orifices are then closed anteriorly by compression between the thumb and fingers. The object is to confine the air blown from the bag to the nasopharynx, and this is done

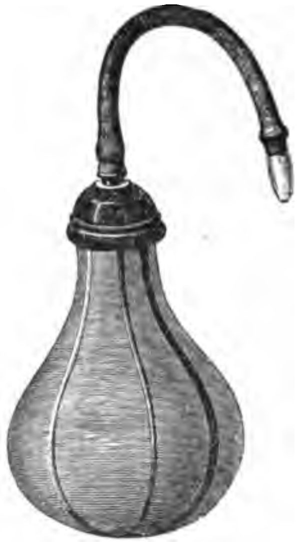

Fig. 75.—Politzer's bag for inflation of the middle ear (Politzerization).

by approximating the palate against the pharyngeal wall. To accomplish the latter object, a little water is taken into the mouth, and at a given signal the patient is told to swallow, and at the moment when the pomum Adami is seen to rise, the bag is compressed. One may dispense with the swallowing method by having the patient say "kick" or "huck" or by puffing the cheeks balloon fashion and then compressing the bag. In children crying will close the nasopharynx by forcing the soft palate upward. If a perforation of the tympanum exists, secretions are forced through it into the external canal, otherwise the air and secretions become mixed and are spread out over the surface of the tympanum. Inflation of the middle ear should be preceded by the use of an antiseptic gargle, after the manner advocated by Haug (page 162). If it is desired to inflate only one ear with the Politzer bag, the head should be placed on one side, with the affected ear uppermost and the other closed with the finger.

Diagnosis.—By means of the auscultation-tube, a perforation of the tympanum is recognized by a hissing or whistling sound if the Eustachian tube is unobstructed. In normal cases only a short blowing sound is heard (*bruit de pluie*). One is also able to determine if the Eustachian tube is patent. Vertigo of ear origin due to an increase in atmospheric pressure resulting from occlusion of the Eustachian tube may be temporarily relieved by Politzerization. Subjective ear-noises and headaches may be similarly influenced. Gradle has shown that a continuous headache may occur from a slight obstruction of the Eustachian tubes, which is at once temporarily relieved by inflation of the middle ear. More permanent relief is then achieved by the removal of adenoids or other causes of obstruction. The so-called *cephalalgia pharyngotympanica* (Legal) is a very severe cephalalgia, paroxysmal in nature, the pain being principally localized in the temporo-occipital region, and easily differentiated from other forms of neuralgia because of the presence of a painful occipital point, with pains affecting the occipital, the supraorbital, and the temporal branch of the subcutaneous malar nerves. The cephalalgia pharyngotympanica is caused by catarrh of the pharynx or of the middle ear. In cases of this nature simple insufflation of the middle ear is sufficient to cure the headache.

Rectum.—This must first be emptied and cleansed by enemata. A Davidson syringe may be used for inflation. When properly inflated, the position of the sigmoid flexure and colon can be defined from the surrounding parts on the anterior abdominal wall, otherwise they may be located by percussion and palpation. Tumors of the gut can be differentiated from other abdominal tumors by movability on palpation and by inflation. Tumors of the kidney and of the mesenteric glands develop behind the bowel. If an abdominal point of tenderness is discovered and one desires to determine whether the sensitive point is associated with the gut, inflation by shifting its position speaks for its intestinal origin.

It is often difficult to say whether certain symptoms are associated with the colon. Inflation of the latter, by creating definite sensations which correspond to the subjective symptoms, directs attention to their colonic origin. I have often inflated the stomach with the same object in view. In instances where the stomach-tube cannot be used, inflation may be attained by the administration of an effervescent mixture. The bladder may be inflated for a like object.

The location of stenoses by inflation is not a reliable method. *Intussusception* is characterized by the presence of a tumor, bloody stools, and tenesmus. It is a common cause of acute intestinal obstruction in children. Inflation of the rectum may be tried for diagnostic and curative purposes. It must be employed with great caution to avoid rupture of the bowel. Wiggin reported sixteen recoveries among thirty-nine children treated by inflation.

Inflation of the rectum may also be done by injecting one dram of a solution of sodium bicarbonate, followed by a like amount of tartaric acid in solution. Carbonic dioxid is thus evolved, but it is open to the objection that the evolved gas is not under control.

Injections of water are used for determining the capacity of the colon and the seat of a stenosis. The normal capacity of the large bowel is about six quarts. Therefore, if six quarts can be introduced by a fountain syringe, there is no obstruction in the large intestine; and if less than four quarts can be introduced, it is in favor of an obstruction. Rectal insufflation of air may locate

PLATE XIV.

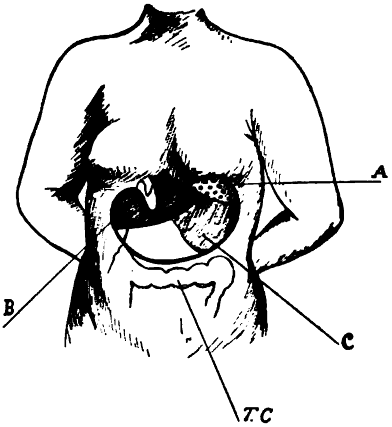

Fig. 76.—Topographic relations of a normal stomach. A, area covered by lung; B, area covered by the liver; C, area of Traube; T.C., transverse colon. The portion of the stomach overlapped by the lung is indicated by the dotted area, and the portion covered by the liver by the shaded area. Traube's area is that portion which is covered by the ribs alone.

the site of the obstruction by causing decided distention below it. In infants not more than a pint and a half should be passed into the bowel from a height of three feet, according to Wiggin. The use of chloroform facilitates inflation and the use of enemata. Irrigation of the rectum may yield a wash-water which after the use of the centrifuge may show cells under the microscope indicating a growth. The same principle is applicable with relation to the stomach and bladder.

Bladder.—In rupture of this organ the injection of a measured quantity of boric-acid solution is not, as a rule, entirely withdrawn by the catheter. Fluid forced into the bladder will not raise the latter into the hypogastric region to permit of its recognition by percussion. Air pumped into the bladder by a Davidson's syringe or a bicycle pump will, when this organ is unruptured, cause it to rise above the pubes as a pyriform tumor yielding a tympanitic percussion sound. In intraperitoneal rupture the air passes into the general peritoneal cavity. If the rupture is extraperitoneal, the extravesical tissues become emphysematous.

Stomach.—The stomach lies in the epigastric and left hypochondriac regions (Fig. 76); five-sixths of its bulk is to the left and one-sixth to the right of the median line. The cardiac orifice lies at a point corresponding to the sternal attachment of the left seventh costal cartilage, 4½ inches behind the anterior surface of the abdomen. The cardia is attached to the esophagus, hence its position is fixed. The pylorus is on a level with the end of the ensiform cartilage, between the right sternal and parasternal lines, and is freely movable. The greater curvature of the stomach in normal cases is never found below the level of the navel, and, as a rule, it lies two to three fingerbreadths (1½ to 2¼ inches) above the navel. To determine the size, shape, and position of the stomach, inflation of the organ may be attempted by means of carbonic acid gas (page 402) or by means of the stomach-tube, to the external end of which is attached the tip of a Davidson syringe or a Politzer bag. Inspection alone or percussion will define the organ.

Ebstein claims that one is justified in diagnosing pyloric insufficiency if continued insufflation produces diffuse abdominal distention in lieu of localized bulging in the epigastrium. The results of localizing the greater curvature may be confirmed after or before inflation when the stomach is relaxed by palpating the tip of the tube from the anterior abdominal wall. To remove the air from the stomach, massage the epigastrium with the tube *in situ*. Meyers[319] suggests the following method for defining the outlines of the stomach. The organ is distended to a moderate tenseness with air, and the air confined by exerting compression on the rubber tube near the mouth of the patient. It is better that the tube be compressed by the fingers of the patient or of a reliable third person, but in cases in which the patient is unintelligent and no third person is at hand, the physician may himself compress the tube as indicated. The viscus is now percussed indirectly, or, if the physician be holding the tube with one hand, directly. It will be noticed that any vibration communicated to the free walls of the stomach will be transmitted to the compressing fingers through the medium of the tube, and that when any other organ is percussed this transmission is absent. Any percussion stroke over a moderately distended colon is not transmitted, and if a colon be so distended that its walls become tense, with the possibility of transmission, such a fact is apparent on inspection of the abdomen alone.

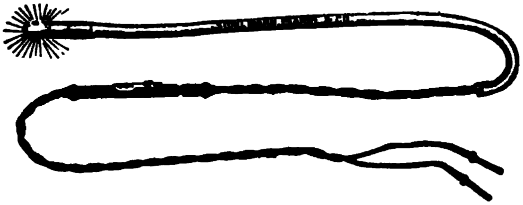

Fig. 77.—Einhorn's gastrodiaphane.

Inflation of the stomach will often bring a tumor into evidence which would otherwise escape detection, and assists in differentiating tumors of the stomach from growths located elsewhere. After the stomach and colon are distended, abdominal tumors recede to those parts of the cavity in which are situated the organs from which they arise (Minkowski). Painful points located in the stomach are better palpated and their position with relation to the anterior abdominal surface is changed.

Air-pump.—There are susceptible individuals who upon the slightest exposure to a draught will cough. The cough is not always provoked, as many suppose, by the inhalation of cold air, for susceptible persons cough even after immersion of the hands or feet in cold water. Although accustomed for years to my morning cold bath, yet every time I enter the latter, I suffer from an attack of coughing. I have tested a number of persons to determine whether particular regions on the surface of the body were sufficiently susceptible to an irritant to cause cough; in a

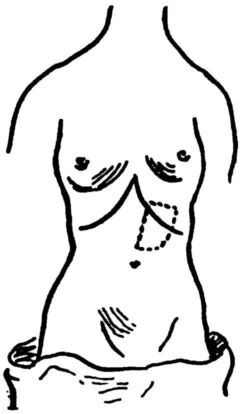

Fig. 78.—Gastrodiaphanic picture in normal stomach.

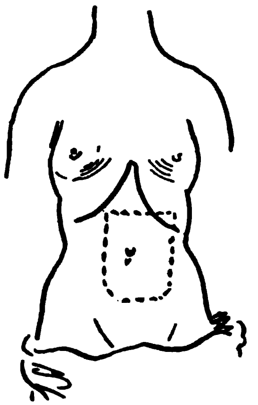

Fig. 79.—Gastrodiaphanic picture in dilated stomach.

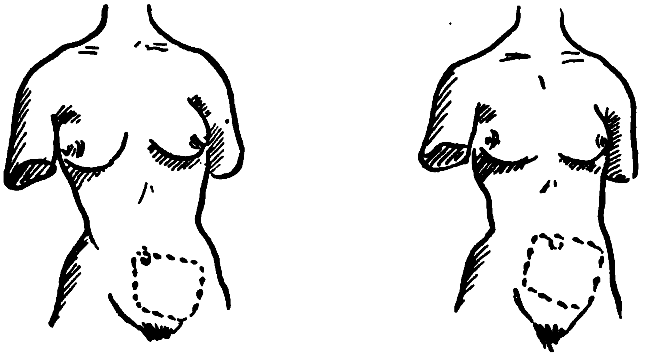

Fig. 80.—Gastrodiaphanic pictures in gastroptosis.

number of instances, I was able to locate such regions, notably on the surface of the neck, and I have called them *tussogenic zones*. As an irritant, a current of cold air from an air-pump was used; and this method may be employed in the diagnosis of skin-coughs. There are individuals who complain of pains, notably in the head and the chest, when exposed to a draught. Such pains may often be elicited when a current of cold air from an air-pump is directed at the points of exits of the nerves at the vertebral column. Very often the patient does not associate his pains with draughts, hence the importance of this aid in diagnosis.

It is well known that a faint syphilitic eruption, notably that of secondary syphilis, may be brought into prominence after a hot bath. If a current of cold air is directed against the area of a faint eruption, it anemizes the healthy skin and renders conspicuous any discoloration which may be present.

Gastrodiaphany.—This is a simple method when the apparatus of Einhorn is employed. It consists of a small electric light at the end of a moderately stiff bougie. The examination is conducted in a dark room with the patient standing. The areas of illumination in normal and abnormal cases correspond to Figs. 78, 79, and 80. By means of fluorescent media, the stomachs of fat or muscular subjects can be illuminated, and by aid of such media, the brilliancy of the usual illumination is very much increased. The method of Kemp is as follows: After the stomach is empty 8 ounces of water containing 15 grains of bicarbonate of soda are swallowed, followed by 8 ounces of water containing the same amount of soda, 1 dram of glycerin and $\frac{1}{8}$ grain of fluorescein.

LAVAGE.

Ear.—The ceruminal glands by hypersecretion may cause impacted cerumen. Aside from hypersecretion, foreign bodies in the external meatus furnish a nucleus around which cerumen collects, and furthermore cerumen accumulations are favored by misdirected efforts at cleansing the ears. Among the symptoms are temporary attacks of deafness, appearing suddenly.

During certain seasons of the year when perspiration is abundant, the cerumen absorbs the moisture, and thus occludes the lumen of the canal. Fullness and confusion in the head, noises in the ear, and vertigo may also be present. For a long time it has been known that irritation of the external auditory meatus, through the auriculo-temporal branch of the fifth nerve, would excite coughing. The introduction of the aural speculum will not infrequently excite this reflex. As a rule, in ear-cough an examination shows the presence of a foreign body, and the cessation of cough after its removal confirms the diagnosis. Even epileptiform attacks have been traced to impacted cerumen or foreign bodies in the canal. The cerumen is easily removed by means of warm water and a syringe (page 161).

According to Wright, cerumen is quickly softened and plugs of desquamated epithelium broken up by filling the meatus with peroxid of hydrogen (20 vols.), and allowing it to remain for a few minutes. The sodden plug can then be readily removed by syringing with hot water.

Enteroclysis.—Robert C. Kemp[126] has been especially prominent in eliciting physiologic data concerning lavage of the intestines. Normal saline solution (one dram of salt to a pint of water) was employed. He found that, if an increase of pulse-tension is to be avoided, irrigation may be done with water ranging from 100° to 104° F. To increase the blood-tension and stimulate the heart, the fluid is employed at a temperature of 110° F., gradually increased to 120° F. Irrigation with the latter is excellent in shock and to prevent shock. Cold is a temporary stimulant, and later acts as a depressant. Enteroclysis with normal saline solutions (110° to 120° F.) increases renal secretions within ten minutes, and markedly so in twenty minutes. The colon of a six-months' infant holds a pint without distention, and at the age of two years, two to three pints.

Technic.—One may employ the high enema or enteroclysis with a double continuous current. The former is administered through a colon-tube or long catheter to which is attached a fountain syringe or similar apparatus. The bag should be suspended two or three feet above the patient, and to prevent intestinal spasm the fluid should be allowed to enter slowly by pinching the tube. The tube should enter the bowel, after lubrication, for a distance from 12 to 14 inches. By allowing some of the fluid to flow, the entrance of the tube is facilitated. In infants a No. 16 or 18 (French) can be used. The dorsal position with elevated hips is the best and the knee-elbow posture may be adopted for a high injection. Olive oil or glycerin may be added to soap-water for softening impacted feces, or spirits of turpentine (ʒss to ʒj) if there is tympanites. When a double continuous current is desired, Kemp's rectal irrigator (Fig. 25) may be used. It permits regulation of the temperature of the solution, and straining to overcome the resistance of the sphincter can be relieved at once by checking the inflow and allowing an increased outflow. After this manner a prolonged irrigation lasting an hour or more may be given. Such continuous irrigation permits the small intestine to evacuate its contents continuously into the lower bowel. When the tip of the instrument passes through the sphincter, start the flow to force the mucosa away from the irrigator. The fountain syringe is attached to the central tube and the carry-off tube to the curved tube. If the flow ceases, rotate the tube slightly, or withdraw it slightly while rotating, and push it back. If the outflow seems to be obstructed, stop the inflow, and then force fluid back through the outflow tube with a small syringe, or detach the fountain syringe and force the flow back through the outflow tube for an instant. Very often "milking" the outflow tube with the fingers will start the flow. Withdraw the instrument by rotation to prevent the mucosa catching in the fenestræ. A double-current irrigator may be improvised by taking two catheters, a smaller one for the entering current and a larger one for the outflow, and passing them through a perineal pad of gauze and cotton covered with oiled silk or through a piece of rubber sheeting.

Diagnosis.—Reference has already been made to inflation in the diagnosis and treatment of intussusception. Here one may employ hydrostatic pressure by means of the colon-tube in adults and a No. 18 catheter in infants. Holt advises the fountain syringe to be suspended four or five feet above the patient. This elevation gives a pressure of not over three pounds to the inch, and it is not advisable to place the bag at a higher elevation. The dorsal with elevated hips or the Trendelenburg posture is adopted and the tumor manipulated through the abdominal wall. Anesthesia is employed. The buttocks should be compressed to prevent the escape of fluid. The quantity of fluid to be injected is gaged by the tension of the abdominal walls, and furthermore by the fact that the infant colon can hold a pint, and the colon of a child at the age of two years between two and three pints, without distention. The adult colon, according to Weir, holds nine pints. Pressure is maintained for from ten to thirty minutes. If the intussusception is not reduced, a second attempt should be made, according to Holt, within two hours, and then if failure occurs, laparotomy should be performed. Clubbe[127] finds that irrigation of the bowel with oil or warm saline, the patient being anesthetized, does away with the necessity for operation in 10 per cent. of the cases. Cole[128] regards irrigation as admissible only during the first six hours after onset. In an analysis of one hundred and ten cases, 73 per cent. recovered after laparotomy, as against 46 per cent. of cases treated exclusively by irrigation.

Test Lavage of the Intestines.—This signifies, according to Boas, a uniform irrigation of the large intestine with water for the purpose of recognizing anomalies of the same (mucus, pus, blood, or fragments of tumors) in the returning water. The intestines being previously emptied, the patient is placed in the lateral position. A soft-rubber tube, not unlike that employed in stomach lavage, after being lubricated is used. Normally the water returns clear or only slightly cloudy, whereas in catarrh of the large intestine large and small shreds of mucus can be demonstrated. This is a simple and exact method for diagnosticating membranous enteritis and affords a criterion of the progress and extent of the disease.

The value of enteroclysis in intoxications corresponds to the employment of hypodermoclysis for the same purpose. In accordance with the prevailing toxemic theory of insanity, colonic is combined with gastric lavage. When colonic lavage is employed for antiseptic purposes, the following may be used: boric acid (1 dram to the quart) or potassium permanganate (4 grains to the quart). In amebic dysentery solutions of quinin (1 to 1000) are used. Enteroclysis is also employed in lieu of vaginal douching in the unmarried for the relief of leukorrhea, to further the absorption of pelvic exudates, etc.

When one has reason to suspect pin-worms (oxyuris vermicularis), tentative injections should be given of a strong decoction of garlic in milk.

Pernicious Anemia.—Many theories have been suggested to explain the hemolysis in this affection, but if one is dictated by the results of treatment, the toxic origin of the disease is most suggestive. The earliest symptoms of this affection are associated with digestive disturbances, and there is a growing tendency to attribute this form of anemia to a toxemia of intestinal origin. Signs of augmented intestinal putrefaction are indicated by the *indicanuria*. Herter has demonstrated the more or less constant presence of anaërobic bacteria in the large intestine, which break down proteids into a form suitable for the use of other putrefactive bacteria, among which are the indol-forming organisms.

The significance of the presence of this excess of indol, according to Hollis and Ditman,[250] whom I quote, was shown by the production of toxic symptoms in animals whose oxidizing capacity had been reduced by small injections of potassium cyanid, causing a condition of diminished oxidation, which is more than likely occurs in conditions of blood-poverty.

These anaërobic organisms produce substances which are strongly hemolytic, so that it only has to be assumed that these substances pass through the intestinal wall more or less intact, to have access with destructive effect to the blood of the portal system, where Hunter has found the greater part of the hemolysis to occur. But the observation of greatest practical value which Herter has made in this connection, was obtained by the demonstration of the action of methylene-blue, which changes to a colorless leukobase upon reduction. By this means he found that oxygen occurred in the intestinal canal as far down as the ileocecal valve, but no further. As these anaërobic bacteria are confined for their place of residence to regions free from oxygen, they must be limited to the large intestine, where they are within reach of therapeutic measures directed from the lower end of the gastro-intestinal canal; hence the possibility which he affirmed of removing them by irrigation of or local applications in the colon.

Acting upon the suggestion of Herter, Hollis and Ditman treated two cases of pernicious anemia by colonic irrigation, using once a day a double current of warm saline solution until the return flow was clear. Although arsenic and strychnin were used without notable effect, in one case there was an immediate response to colonic irrigation. The other patient was likewise restored to health. The foregoing observation recalls the famous dictum of Sir Andrew Clark, viz., that if he were limited to the choice of one drug in the treatment of chlorosis, he would choose a purgative. The fact is, one must not be bound by set rules in the diagnosis of the various forms of anemia, and before excluding intestinal toxemia as an etiologic factor, one must employ a thorough method of treatment, like colonic irrigation, to achieve intestinal asepsis.

Enterogenic Cyanosis.—Many cases of cyanosis have been reported caused by the absorption of toxic products from the intestine. The blood may show the presence of either methemoglobin or sulphohemoglobin. These cases recover after thorough purgation or by an exclusive milk diet or both.

Stomach Lavage.—For method of employment, *vide* page 162. The tube is chiefly used as a means of obtaining the stomach contents for analysis (stomach; chapter, diagnosis of visceral sufficiency). The diagnosis of many gastric affections may be determined by the results of lavage. As a rule, if lavage is of any value in treatment, its results are immediate. Its use is imperative in all conditions conducing to stagnation of food, as in dilatation of the organ, narrowing of the pyloric orifice, or in atony of the muscular walls.* A few nervous affections can be traced directly to some disorder of the stomach. Thus tetany is often caused by gastro-intestinal disorders, notably dilatation of the stomach, for which relief may be secured by regular lavage with saline or antiseptic solutions. The best time for lavage is before breakfast or at bedtime. At the former time the washing does not remove food destined for nutrition; at the latter time it is advisable when fermenting food prevents sleep or causes attacks of gastralgia. When the nature of the gastric affection is unknown, tepid or warm water is used for lavage. If there is hyperacidity, sodium bicarbonate (tablespoonful to a quart of water) is used. If there is a deficiency of acid, salt (teaspoonful to a quart of water) is employed. Sodium chlorid is generally regarded as an excitant of HCl secretion. If there is much mucus, sodium bicarbonate is indicated.

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* *Dyspeptic symptoms* are usually of extra-gastric origin, if not relieved by alkalies, carminatives, vomiting or the stomach-tube. As a rule, the dyspeptic symptoms of a *gastric ulcer* disappear temporarily when the stomach is washed out.

In fermentation a 3 per cent. solution of boric acid is used. Irrigation once a day is sufficient, and in debilitation every other day. Lavage must be continued until the return water is clear, and it is better to remove all or nearly all of the fluid. In the diagnosis of aneurismal pulsations, the stomach-tube has been employed as an *aneurismatoscope* by Schnell or for intrathoracic auscultation by Richardson. The aneurismatoscope, for the diagnosis of aneurisms of the descending aorta, consists of an ordinary soft-rubber stomach-tube closed at the lower end, and containing at its upper end a glass tube. The whole is then filled with any colored fluid up to the glass tube, and when the rubber tube is introduced into the esophagus, the pulsations of the aneurism are transmitted to the fluid in the tube, and can thus be recognized. In Richardson's method the stomach-tube has a large aperture at the lower end for the better conduction of sound and the upper end is connected with a binaural stethoscope. Aneurisms pulsating along the esophagus and stomach are thus detected.

Ewald directs attention to an early and trustworthy sign of *ileus*, viz., that the stomach-tube will aspirate fecal smelling stomach-contents. When the affection is more advanced, the contents are fecal.

In some cases of *chlorosis* iron does no good, and this is particularly the case when there are associated symptoms of dyspepsia suggesting dilatation of the stomach. Here the stomach-contents, if removed in the morning, will show food eaten the previous evening. In such cases washing of the stomach for about three weeks will accomplish results incapable of achievement by the prolonged use of iron. In still other instances intestinal antiseptics must be employed when the associated symptoms are intestinal.

Urethra and Bladder.—(Page 167.)

Vagina.--Lavage of the vagina may bring to light foreign bodies of various kinds, such as a forgotten tampon or objects mischievously introduced. When urine is obtained from women for examination; either the vagina must be thoroughly irrigated before the urine is voided or the urine must be drawn with a catheter to exclude vaginal contamination. Seat-worms may find their way into the vagina and cause vaginitis, self-abuse, and other symptoms. The worms may be dislodged from the rectum or vagina by the usual anthelmintics employed for this purpose.

MAGNET.

Foreign bodies in the eye are usually revealed by means of an *x*-ray photograph. If the foreign body is of iron or steel, the giant electromagnet of Haab will demonstrate its presence by the production of pain or by bulging of the iris or the forward movement of the lens when the body is in the latter structure, when the point of the magnet is brought near the eyeball. The sideroscope, a magnetic needle suspended upon a silk thread, will also assist in the diagnosis. The magnet has been employed in *gynecology* by Sellheim.[273] The latter studied the movements of the uterus under the influence of a powerful magnet applied outside, with a large soft-iron catheter introduced inside the uterus. The iron inside the uterus follows the movements of the magnet outside, and the organ thus changes its position at the will of the examiner. The procedure is not more difficult or serious than the introduction of any ordinary sound into the uterus. The rod has a projecting rim which prevents its slipping in too far; it is a little more than two inches long by nearly half an inch in diameter. The large electromagnet is mounted vertically on a standard with a horizontal rod and weight to balance it, so that it can be adjusted and moved around readily. The physician palpates with his right hand through the abdominal walls, while with his left hand he explores simultaneously the rectum and vagina. The tip of the intrauterine rod is kept pointed toward the center of the magnet, thus utilizing the maximum of attraction. The force is sufficient to straighten the retroflexed uterus with no danger of by-effects. It is practically useful as a means of familiarizing the novice with the uterus, giving the organ into his hands, as it were, for him to study. It is also useful as a means of mobilizing the uterus and preventing the development of adhesions after inflammatory processes and displacements. The alternate lifting and dropping of the uterus can also be utilized as a kind of massage. The moral effect on the patients is also an important factor, as they can feel the displaced organ return to its normal place under the mysterious influence of the magnet.

MASSAGE.

Physiologic Effects.—The pressure exerted by massage influences all the tissues within its reach. On muscles it increases the power of endurance and abolishes fatigue. Experiments on frogs show that after the muscles are exhausted by an induction current, their lost vigor is soon restored by massage, while rest without massage has no effect. One person experimented upon by Zabludowski lifted a weight of 1 kilo 840 times at intervals of one second, and after this he could do no more. When the arm had been masséed for five minutes, he lifted the weight 1100 times without fatigue.

Massage increases the flow of blood and lymph. Brunton has shown that the blood passes three times more rapidly through a part while it is being masséed than when it is not. In many cases there is an increase in the number of red corpuscles and of the hemoglobin. Upon the nervous system massage, if properly given, has a sedative effect.

Therapeutics.—1. In assisting the peripheral circulation it lessens the work of the heart, hence its value in many cardiac affections.

2. In tissues accessible to manipulation it hastens the resorption of exudations and separates adhesions in joints and tendon-sheaths.

3. It augments the oxidizing powers of the blood, thus modifying disturbances in its composition.

4. By stimulating the sympathetic nervous system it promotes secretions and various reflexes, and thus affords relief in functional derangements.

5. By increasing the flow of blood in the muscles it relieves congestion of the viscera.

6. Wright has shown that the effect of massage on an infected joint, by discharging a number of bacteria into the circulating blood, is to raise the opsonic index, after temporarily lowering it in the first place.

Diagnosis.—Dowse[130] in his excellent manual is sponsor for the observation that if a person is lean by heredity and he puts on fat abnormally, massage will bring about its absorption. If, however, the patient is fat by heredity, and he becomes lean, massage will in him promote the rapid development of fat (organic disease excluded).

In the manipulation of *joints* Dowse cautions us that a slight elevation of temperature of the joint indicates that extreme caution is necessary, and as long as the increased temperature persists, the joint should be let alone. Joints should not be manipulated at night, but in the morning. There is an intimate association between the muscles and the joints, and the former are the masters of the latter. Pain in a joint is more often relieved by extension than by flexion. The good achieved in manipulating a joint is, in the majority of cases, inversely proportionate to the amount of force that is required. Marsh observes that cases are frequently encountered in which force could be exercised almost with the finger and thumb when muscular relaxation has been secured by the use of an anesthetic sufficient to restore free use to a limb that has been disabled for months by pain and stiffness on any attempt at movement. Experiments made on dogs by Menzel and Reyher show that immobilization of the joints suffices to provoke cartilaginous alterations leading to ankylosis if let alone. The movements of the joints are painful and may be preceded by an injection of morphin, the use of an anesthetic, or the injection into the joint of cocain (0.05 cubic centimeter of a five per cent. solution).

Arthritis deformans is essentially a disease of old age, and chiefly affects the hip-joint and the joints of the fingers and toes. In the early stages it is often difficult to differentiate it from chronic articular rheumatism. In the latter affection connective-tissue ankylosis occurs, which is absent in arthritis deformans, hence when passive movements of the joint are made, grinding sounds are heard in the rheumatic joint, caused by laceration of the connective-tissue threads.*

Acute osteomyelitis and other affections of a bone are often mistaken for joint trouble. Here tenderness is specially located near, rather than in, the joints, and tapping on the bone away from the joint will elicit the chief source of pain. Very often spastic and painful affections of the *muscles* contiguous to the joint may simulate an articular trouble, and it is only after treatment by massage or the faradic current that the true nature of the trouble is revealed. One must never avoid testing the active and passive movement of the joints in painful affections of the extremities. A slight *ankylosis*, notably of the shoulder, is not uncommon, and the adhesions are concealed by the compensatory movement of the scapula. It is known than any elevation of the arm normally beyond the horizontal is effected by rotation of the scapula; hence in testing this joint, fix the scapula. It is surprising how frequently such ankyloses are overlooked by the physician. Even after the first manipulations of the joint there is some amelioration of the pains. Similarly, I have frequently cured intractable cases of sciatica by passive movements of the hip-joint. *Sciatica* may also be caused by chronic arthritis of the spinal column (*vide* suspension). In other instances one may hypothetically assume the existence of adhesions along the course of the nerve, for which stretching of the nerve is diagnostic by the resulting cure. With the patient in the horizontal posture and anesthetized, the affected limb is extended at the knee and forced a number of times in the direction of the head. The unaffected limb may be used for comparison. Sciatica in some instances may be a neurosis.

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* When it is a question between a functional and an organic joint-lesion, my experience has been that, if *fever* follows passive movements of the joint, it suggests an infectious lesion, and the leukocyte count, as a rule, is increased.

Martin and Parturier suggest the following (contra-lateral sign) as a valuable symptom in sciatica: The patient reclines without a pillow, and the thigh on the sound side is raised and flexed on the pelvis as he lies still. At a certain point the flexion causes a sharp pain in the buttocks on the affected side, generally at the sciatic point.

The *Babinski sign* may be employed in diagnosis: in true sciatica there is diminution or absence of the Achilles-tendon reflex, which in hysteric sciatica is unaffected. This reflex is best obtained with the patient in the position shown in Fig. 81. On striking the Achilles tendon there is flexion of the foot. *Grating* in a joint, when not pronounced, can often be heard by aid of the stethoscope. *Bursal enlargements* are either isolated or communicate with the synovial cavity. In the former instance the intumescence is easily movable on the tissues surrounding it and the joint. It fluctuates but is not compressible, and the outlines of the joint can be defined. If the swelling communicates with the synovial cavity, then placing the joint in the position of greatest capacity (usually semiflexion) transfers the contents of the swelling to the joint. The joint affections of *hysteria* may follow an insignificant

PLATE XV.

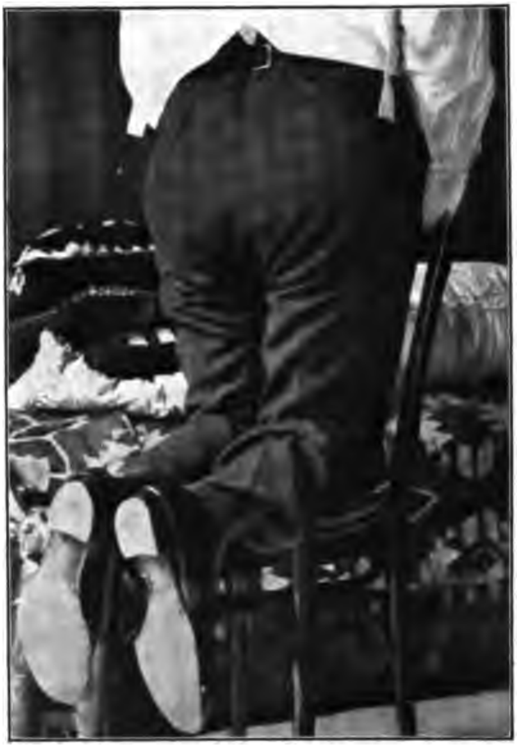

Fig. 81.—Posture for eliciting the Achilles tendon-reflex.

injury. They may prove extremely refractory to treatment, yet the simple manipulations of a charlatan may cause the immediate disappearance of the trouble. The patient may complain of severe pains, and even a most careful examination reveals nothing, despite the fact that the joint is fixed and sensitive. A pathognomonic feature is this, that a slight touch is frequently as painful as when the joint is roughly handled. In other instances the joint is swollen and the temperature may be normal or increased. The pains are often nocturnal. Distracting the patient while the joint is manipulated causes the pain to disappear. Before concluding that the trouble is neuromimetic, the joint should be examined during anesthesia.

Nervous Pain.—The physician is inclined to disregard the pains of neurotics. In many instances the skin is hyperesthetic, and frictions with a rough fabric of cotton, to induce intense irritation of the skin, are followed by cure of the pains in question, whether located in the back, precordium, or elsewhere. It is a satisfactory diagnostic method, and should be tried, according to Lots,[244] in all such cases.

Spine.—Dowse observes that ten minutes' massage at the spine will increase the volume of the pulse and the temperature generally more than an hour's work at the body as a whole, the spine being omitted. Many competent observers claim that pressure massage on the points of emergence from the cranium and spinal column of different nerves can be made to contract or dilate the vessels in different parts of the body. John P. Arnold,[131] of Philadelphia, has done admirable work in this regard. The latter has assured me of the excellent results obtained by him by digital pressure at the points of exit of the implicated nerves. Such points are detected by allowing the patient to lie down upon one side, and then by running the fingers alongside of the spine on either side, one feels in place of the soft mass of muscular fiber a hard and tense mass which is sensitive on pressure. These sensitive points are subjected to treatment by massage, vibration, and electricity. In the use of the galvanic current one must follow the general rule in galvanotherapy: The anode is applied to parts with exalted and the cathode to parts with diminished sensibility.

Visceral disease is frequently associated with hyperesthetic reflex centers in the spinal cord, which may be located and treated by massage, vibration, etc., of the tender areas. Geyser locates such centers by the use of a high-tension faradic coil. Such a coil is only of value if it can illuminate a 4- to 6-inch Geissler tube. With the patient's back bared, one pole of the battery is attached to a 6 by 6 inches moist electrode and applied over the epigastric plexus. The other electrode (2 by 2 inches), well moistened, is passed lightly over the spinal column with a current-strength sufficient to be agreeable. The current is passed up and down the entire length of the spinal column with ordinary pressure, three to five times. The areas are characterized by the presence of vivid red spots which become more prominent after five minutes. The spots in question are tender or painful on pressure. The painful points may also be detected by percussion of the vertebræ.

Vertebral points of tenderness associated with visceral diseases must be differentiated from the tenderness coupled with intercostal neuralgia. In the latter affection the *puncta dolorosa* (points douloureux) are present. The foregoing fact may be illustrated as follows: The usual points of tenderness in *ulcer of the stomach* are: 1. From the xiphoid process to the umbilicus. 2. In the apex of the angle on each side between the outer border of the rectus and the costal arch. 3. At a point about 2 cm. to the right and above the umbilicus. 4. The lower part of the sternum (Schmidt). The pain on palpation may be a visceral referred pain (*vide* hyperalgesic zones), or it may be due to direct pressure on the ulcer. Pain referred to the skin units or dermatomes of Head will usually disappear after freezing (*vide* psychrotherapy) alongside of the sensitive vertebræ corresponding to the involved segment of the spinal cord; if it does not and only does so after the ingestion of orthoform (*q. v.*), the pain is caused by direct pressure on the ulcer. A frequent area of vertebral tenderness in gastric ulcer is at the level of, and to the left of, the tenth to the twelfth dorsal vertebræ.

It is well to remember that the tenderness of the hysterical spine is diffused and not localized.

Vertebral Tenderness.—Tenderness of the vertebræ is rarely absent in neurasthenia. Sensitive areas occur in neurasthenia as in hysteria. These topoalgias may be located in any region of the body and do not disappear until treatment is directed to the general condition. When the topoalgia is limited to the vertebral column, it is known as rachialgia. In acute transverse myelitis there is frequently a zone of hyperesthesia at the level of the lesion, which may be discovered by passing a test-tube containing hot water along the spine, when the sensation of warmth changes to one of actual pain. In ulcer of the stomach Boas claims that there is a painful dorsal point found at the level of, and to the left of, the tenth to the twelfth dorsal vertebræ. The painful area lies usually directly against the vertebræ. In no other affection of the stomach is such a painful area to be found with equal constancy. In cholelithiasis the same author finds a painful area somewhat to the right of the twelfth dorsal vertebra, which is present not only during an attack, but for months thereafter. In caries of the vertebræ the spinal processes of the affected vertebræ are painful on pressure and pain is experienced when the vertebral column is moved. The muscles in the implicated district are nearly always rigid. In intercostal neuralgia percussion of the spines of the vertebræ corresponding to the affected nerves will always elicit pain. Painful points in the back escape recognition by palpation owing to the dense and contracted musculature. For this reason the patient should lean backward so as to relax the muscles.

Hepatic Tenderness.—In *hepatic insufficiency* associated with splanchnic neurasthenia and intestinal auto-intoxication an invariable sensitive spot on palpation is located midway between the ensiform cartilage and umbilicus, and is detected at the end of inspiration during the time the patient inclines his body forward. Firm pressure must be exerted by the physician. Massage of the liver, properly executed, is diagnostic in two directions, viz., by the evanescence of the sensitiveness of the organ and by demonstrating the presence of indican in the urine. How may the liver be correctly massaged? The author recommends a form which he has designated respiratory massage. One knows that in correct abdominal breathing the liver is rhythmically compressed between the diaphragm and the anterior abdominal wall. We are able to duplicate and accentuate physiologic compression of the liver by substituting the fingers of the patient for the anterior abdominal wall. The physician should execute massage of the liver for diagnostic purposes. The patient is placed in the recumbent posture with thighs flexed on the abdomen. The fingers are then passed successively under the ribs in the axillary, mammary, and parasternal lines, respectively, and in the median line. During the time the patient takes a forced inspiration with mouth open, pressure is executed backward with the fingers as though an effort were made to prevent the liver from descending. After this manner the patient takes at least a hundred deep inspirations, resting from time to time. In splanchnic neurasthenia and in intestinal auto-intoxication the sensitiveness of the liver will evanesce after a single séance of this kind. The author has shown in his work, "Man and His Poisons," that abdominal massage will increase the quantity of indican in the urine, and that after such massage indicanuria may be present, although previously absent. In this as well as in the test to be described the urine is examined immediately before and after execution of the massage, *i. e.*, the urine voided before and after must be examined separately and compared. Now, indicanuria is not always present in auto-intoxication, for the reason that it accumulates in the liver and is not excreted. Baumann contends that the synthesis of the indol into an ethereal sulphate is formed in the hepatic cells. I have found that massage of the liver, executed after the manner cited, causes the appearance of indican in the urine, although previously absent, hence one may conclude that if indican is found in the urine after respiratory massage of the liver, the organ is performing its work. Again, such massage causes a notable increase of indican in the urine in splanchnic neurasthenia and auto-intoxication, and with the diminished excretion of indican by daily séances of massage, the condition of the patient is ameliorated. In some instances the quantity of urea excreted is likewise augmented after the massage. If Baumann's theory is correct, abdominal massage increases the indican, for the reason that the circulation in the liver is also improved by such massage.

One must not forget that there is such a condition as "indigestion toxemia," due either to an excessive production of poisons or resulting from enfeeblement of the defenses. Thus, there is an hepatic as well as a gastric and intestinal dyspepsia, and the liver dare not be ignored even in the treatment of an ailment so plebeian as dyspepsia.

It is often difficult to say whether certain *reflex pains* are of hepatic origin, but if one remembers that if the liver is correctly palpated, or even massaged, not only may such pains be accentuated, but they may also be reproduced. Clinical observations have taught the author that reflex pains of hepatic genesis are usually located as follows: (1) The region of the apex of the heart, especially when the left lobe of the organ is implicated and the pains are of a stabbing character; (2) dull pains on the right side corresponding to the ninth or tenth ribs and extending to the vertebral column or the right shoulder; (3) dull pains located on the right side at some point between the lower ribs and the navel. Palpation of the spleen may also be made with the same object in view.

Referring again to *indicanuria* as an evidence of hepatic insufficiency, attention must be directed to the fact that the test for indican is not always a true index of the toxicity of the organism, insomuch as much of the indican may pass out with the feces, notwithstanding the toxins may continue to be absorbed. Retardation of the bowel activity with intestinal astringents will increase the amount of indican in the urine, whereas purgatives will diminish the output. When indicanuria is present, other disturbances in metabolism are the overproduction of uric acid and an excessive excretion of the earthy phosphates. Overproduction of uric acid may be demonstrated by the test of Porter: After boiling the upper strata of urine add a few drops of 4 per cent. acetic acid. Allow it to stand for about four hours, after which overproduced uric acid will crystallize out just beneath the surface of the urine in the test-tube. Test for the *earthy phosphates:* Fill test-tube one-third full with urine and add a few drops of caustic potash and heat until the phosphates are all precipitated. After the tube stands for fifteen minutes, a normal amount is represented by a deposit 1 cm. high in an ordinary sized test-tube.

Genito-urinary Diseases.—Urethral discharges when apparently absent may be pressed out by grasping the penis with the thumb and forefinger and passing vertically toward the meatus. In massage of the prostate Valentine and Townsend[824] recommend the gynecologic position as the best, with knees well bent and allowed to hang apart as widely as they will fall. Gouley's lubricant for the finger is recommended and the hands are protected by rubber gloves. In the absence of the latter the examining finger may be dipped into the following varnish, which dries instantly and does not crack: copal, 2.0; Venetian turpentine, 4.0; sulphuric ether, 100.0; collodion, 100.0; acetone, 8.0.

Locating the Prostate and Vesicles.—The operator continually occupied in this class of work, and he who has recently refreshed his studies of anatomic relations, will recognize the apex of the prostate the instant his finger-tip has traversed the rectal covering of the *pars nuda urethræ.* The finger then passes successively around each outer margin of the organ to its base; and then down between the lobes to outline the interlobular cleft, when it exists. The finger will then pass up from one outer side of the base of the prostate to search for the seminal vesicle of that side, repeating the procedure for the opposite side. In health these organs can be felt only with great difficulty, and then only as soft strings. In disease the vesicles may be considerably enlarged and yet not be palpable, when a very much enlarged prostate rises as an obstacle below them. It must be kept in mind also that the ampullæ of the vasa deferentia lie close to the seminal vesicles, and in fact join them to form the common ejaculatory ducts. In consequence, inflammatory swelling of the ampulla of a vas, which exceptionally occurs, may convey to the examining finger all the appearances of a vesiculitis.

Order of Stripping and Massage.—It is generally accepted that the vesicles should be stripped and the prostate massaged in the order mentioned. This proves erroneous in practice. When the prostate requires massage, it holds material which it is unable to unload without mechanical aid. It then is likely by pressure to occlude the common ejaculatory duct; consequently it should first be emptied as much as possible.

Technic of Prostatic Massage.—The apex of the prostate should be the first point of attack. The finger is partly bent and slightly withdrawn with each downward stroke. The strokes at first are performed very gently and their force gradually increased until the point massaged is felt to grow softer under the compressing finger. The same process is repeated for each lobe, extending the manipulations higher and higher until the base of the organ is reached, whenever this is possible. Ordinarily extrusion of prostatic juice from the meatus will begin before the finger has attained the middle of either lobe.

Stripping the Vesicles.—After the prostate has been sufficiently massaged, stripping the vesicles is performed in the same manner, except that lateral strokes are added to those from above downward. These lateral strippings must be performed on each side, from without to the median line, on account of the angle which each vesicle forms upon itself. Without these lateral strippings only the lower part of the vesicles could be relieved.

The force employed in massage is guided by experience and judgment. If the contact of the finger with certain points in the prostate and vesicles gives more pain than when other parts are treated, the sensitive ones should be more lightly pressed upon. Under cautious digitization the sensitiveness of these points will soon disappear. As in all similar procedures, gentleness does not exclude thoroughness.

Prostatorrhea is a functional disturbance, independent of specific causes. A milky white discharge is usually present at the end of micturition or during defecation. The urine is usually normal and a rectal examination shows a normal prostate. Massage of the prostate will yield a milky fluid which under the microscope shows the absence of pus. Chronic prostatitis occurs usually in association with inflammation of the deep urethra. It produces all kinds of sensations in the rectum and perineum, and, like prostatorrhea, conduces to neurasthenia and sexual debility. The prostate is enlarged, tender, and indurated. Massage of the prostate yields a fluid containing pus (*vide* three-glass catheter test, page 422). Ballenger[217] directs attention to a *proteid reaction* characteristic of prostatitis which is of value provided the urine previous to massage of the prostate has been found to contain no albumin. The urine is superimposed on a saturated solution of magnesium sulphate (9 parts) and nitric acid (1 part); a white ring at the zone of contact indicates the presence of any proteid.

It is often of importance to recognize *semen*, which is detected with certainty by the demonstration of spermatozoa microscopically. A chemical test for human semen is that of Florence: The reagent consists of pure potassium iodid, 1.65 gm.; iodin (previously washed), 2.54 gm.; distilled water, 30 gm. A minute drop of the reagent brought in contact with the fluid or stain on a microscopic slide forms a brownish precipitate, which when examined microscopically shows minute brown crystals, often arranged in groups if the stain or fluid in question is seminal. Chronic seminal vesiculitis is usually associated with advanced prostatitis. Rectal examination shows enlarged, indurated, and sensitive vesicles, and the microscope shows the characteristic feature of vesicular inflammation, viz., dead and living spermatozoa.

Many remarkable cures of *gonorrheal arthritis* have been reported by Fuller, who insists that the infectious material is derived from a gonorrheal vesiculitis, and by opening and draining immediate relief of the arthritis occurs.

Brönnum[246] found that he was able to express the pathologic secretion from the seminal vesicles after urination, expression of the prostate, renewed urination, and rinsing out of the urethra with a solution of boric acid. The bladder is then filled with the boric acid solution, the catheter withdrawn, and the seminal vesicle on the side of the epididymitis is manipulated with the fingers. The contents of the bladder are then withdrawn and centrifugated and the sediment examined for leukocytes and gonococci. He had positive findings in this respect in sixteen out of twenty cases of gonorrheal epididymitis at the Frederiksberg Hospital, that is, in 80 per cent. In the other cases leukocytes were found without gonococci, and in only one case were the findings negative. The seminal vesicle was swollen in fifteen of the cases. He noted enlargement of the seminal vesicle in a number of other cases, not included in these statistics, which are restricted to those cases in which the above technic or expression was applied. He calls it the "complete expression-method," and advises its application in every case of gonorrheal epididymitis, although not at every examination. It is not necessary to use it except for the vesicle on the affected side. He stains the centrifugated sediment with methylene-blue for examination under the microscope, and uses the Gram technic in dubious cases. The careful preliminary expression of the prostate and cleansing of the urethra eliminate, he thinks, the danger of error from admixture of secretion from other points. He is careful to restrict the palpation to the single seminal vesicle involved.

To determine whether *gonorrheal infection* is present in an inflamed prostate or seminal vesicle it is of great importance to ascertain whether the patient is cured or to account for recurrent urethral discharges. Ballenger does not trust to an examination of the secretions obtained from the structures mentioned, but proposes the following test: The urethra is first irritated by injecting about one ounce of a 0.5 to a 2 per cent. solution of silver nitrate with a soft catheter and syringe or similar device for placing it in the anterior and posterior urethra. In about three hours after the secretion has become established the patient urinates, and the meatus is sealed with collodion or a bit of zinc oxid adhesive plaster. The prostate and vesicles are now massaged. When the patient is compelled to urinate, the meatus is unsealed, and after intervals of two, four, six, or twelve hours, the secretion is examined for gonococci. The method is based on the fact that there is no better culture-medium for the gonococcus than is the inflamed urethra. Irons[382] has noted in individuals suffering from obscure complications of gonorrheal origin, that an injection of dead gonococci is followed by a slight rise of temperature and an accentuation of the local symptoms (in the joints or elsewhere). No manifestations follow the injections in normal individuals. It was also noted that massage of the prostate, when the latter gland is infected, has nearly the same effect as an injection of dead gonococci.

Le Fur[247] noted that rheumatism and other articular affections of gonorrheal origin are ameliorated and cured after prostatic massage; in other words, the prostate is often the source of infection.

Chas. G. Levison has directed my attention to a valuable sign in *renal disease.* If blood or pus is absent in the urine, massage of the kidney in nephrolithiasis, malignant disease, and pyonephrosis will cause blood and pus respectively to appear in the urine. To massage the kidney, put patient in the posture shown in Fig. 21; one hand rests partly upon the two lower ribs and the lumbar region; the other hand is laid flat upon the abdomen in front, immediately below the costal margin, just outside of the rectus muscle. The patient is instructed to breathe slowly and deeply, and during expiration pressure is exerted by the fingers in front against counter-pressure made by the hand under the back, and, at the same time, an effort is made to grasp the kidney. Cowie[249] refers to the difficulty of ureteral catheterization and demonstrates that by kidney massage he was able to find tubercle bacilli in the urine in a case of tuberculosis of the kidney.

Cowie[378] employs the following method of *massage of the kidney* for urinary segregation: The bladder is washed with sterile water until the water returns perfectly clear; the patient is then turned on one side, and the kidney on this side is massaged vigorously for five minutes by kneading, grasping the abdominal wall in the region of the kidney between the thumbs and fingers of both hands and pressing high up under the ribs; have the patient take a deep breath, and while it is held the kneading is continued. All other forms of massage are applied over the kidney region. A catheter is then introduced and the urine is saved for examination; if, however, there be no urinous flow, then the bladder is washed with sterile water and the water collected in a sterile flask for examination. The same process is repeated on the other side. Cowie claims that it is very easy to demonstrate tubercle bacilli or other germs in the material recovered from each massaged kidney. He also urges careful cytologic examinations of urine, and lays special stress upon the fact that if mononuclear cells are found in the sediment, it means search for tubercle bacilli, the same as the finding of casts prompts us to test for albumin or *vice versâ*.

In kidney disease massage of the renal region, according to Callisto, will in interstitial disease decrease the proportion of albumin, increase diuresis and the specific gravity of the urine, and augment the percentage of total nitrogen and chlorids. The composition of the urine in acute parenchymatous nephritis, however, is made worse by this method of massage.

In *paralysis of the bladder* manual expression may be used in lieu of catheterization. The physician sits facing the patient and places his thumbs over the symphysis while the fingers grasp the bladder above. Pressure is then made downward with the fingers until their tips approach the thumbs. The process is repeated until the bladder is completely emptied.

Pressure-therapy.—A recent method of treatment in Germany is called "*Belastungstherapie.*" It is known that 95 per cent.

of all perimetritic and parametritic exudates heal without suppuration. By aid of pressure-therapy, which consists of making pressure and counter-pressure on the exudate, the latter is brought to resorption. The method is also diagnostic. The patient is placed in the dorsal posture with pelvis elevated. A bag filled with shot weighing 1 or 2 kilos is bandaged to the abdomen. A colpeurynter after lubrication is introduced into the vagina. In the rubber tube of the colpeurynter a glass funnel is fixed, and into the latter is poured about 500 grams of mercury. If the treatment is tolerated, more mercury is used at subsequent treatments. If fever follows the treatment, pus is present in the exudate. The occurrence of fever in large exudates calls for operative interference, and if the exudate is small, it indicates that the treatment must be discontinued. The absence of fever speaks in favor of a continuance of the treatment, and the séance may gradually be lengthened to two hours. After removal of the colpeurynter an ichthyol tampon is used. Good results are reported.

Appendicitis.—Rovsing[347] has found that pressure on the corresponding point on the left side will provoke the typical pain at the McBurney point in appendicitis, but not in other abdominal affections. Rovsing[359] in another contribution places in evidence the painful McBurney point without recourse to conventional palpation in the right iliac fossa, which is conceded not to be invariably painful owing to its occasional anomalous position, and owing to contraction of the abdominal muscles. Furthermore, other painful conditions of the abdominal parietes may conduce to an error in diagnosis. Rovsing seeks to locate the appendix and pain in the same by increasing intra-abdominal tension in the region of the cecum by the following method: Pressure is made with the palm of the right hand in the left iliac fossa, and the same hand is allowed to glide along the descending colon in such a way that the intestinal gases are forced into the transverse and descending colon, where they eventually enter the cecum and appendix.

Scoliosis must be differentiated from simple lateral deviation (a functional and readily corrected condition) by the fact that in the former affection flexion of the spine accentuates the deformity, whereas in lateral deviation the deformity is obliterated. Again, the horizontal posture causes the curvature to disappear, whereas in true lateral curvature it persists. A neglected lateral deviation may become a true scoliosis. Rigidity of the spine of recent date which fails to yield to massage and gentle passive manipulation is strongly suggestive of spinal caries.

Reflex urethral pains may be duplicated when the sound in the urethra comes into contact with the offending lesion. Reflex rectal pains may be duplicated when the finger comes in contact with the offending lesion.

In women who suffer from *coccygodynia* the pains may be reproduced by inserting the index-finger into the rectum, and with the thumb and finger grasping the coccyx, move the latter structure.

In a suspected *echinococcus cyst* massage, or even pressure of the latter, may be followed by an attack of urticaria, for it is a recognized fact that any resorption of the fluid of such a cyst is associated with a dermatosis of this kind.

Rheumatism and Headaches.—In chronic rheumatism the essential pathologic condition is the proliferation of connective tissue due to the invasion of microbes or toxins. As a result, fibrous indurations ensue, which vary in size from a pea to an almond, and many of them are attached to the nerves. This fibrous tissue, after exposure to cold, wet, etc., swells and gives rise to the ache and stiffness which are described as rheumatic. If the skin is anointed with oil or vaselin and the finger passed over the part with firm pressure, the fibrous indurations may be felt. If the latter are of recent origin, they may be resolved by massage. Many forms of headache are caused by the compression of nerves by proliferated connective tissue. Painful points are usually detected at the free margin of the trapezius, sternocleidomastoid, temporal, orbital, and occipito-frontal muscles. Other points may also be found. If these painful points are massaged with the finger by rotary movement until the finger no longer elicits pain, many intractable headaches, of a neurasthenic, neuralgic, or migraine type, may be made to disappear.

PESSARIES.

Displacements of the uterus cause many local and reflex symptoms, and while the physician may not be favorably disposed toward the use of a pessary, it is often necessary for him to say whether the symptoms in question are benefited by correction of the displacement. This is especially important when operative measures are indicated, for it frequently happens that patients, in lieu of receiving benefit from an operation, are really worse off than before. It is true that the pessary often fails to benefit owing to the presence of inflammatory adhesions. In a number of instances a well-fitting *abdominal support* will relieve the symptoms, and should be tried. Patients who wear pessaries must frequently be examined by the physician, for the sensitiveness of the vagina is slight and pressure-ulceration may occur with bladder and rectal perforations. Complications like the foregoing are usually preceded by an abnormal vaginal discharge, and the patient apprised of this fact will not delay in seeking counsel. Unless a uterus can be first replaced, a pessary is useless. If it can be replaced, and notwithstanding the use of a proper pessary it resumes its faulty position, the latter is equally useless. Nothing can be expected of a pessary if the perineum is faulty or if there is an incomplete posterior cul-de-sac. After the introduction of a pessary the patient is instructed to walk and make different kinds of movements to determine if the pessary causes pain, and if so, it should be removed. The patient should be seen after several days to note whether the pessary holds the organ in place. If the finger cannot be inserted between the pessary and vaginal wall, the pessary is too large and may cause ulceration. Once a month the pessary must be removed and cleaned and a vaginal douche must be used frequently.

Stem-pessary.—Many symptoms are attributable to amenorrhea and dysmenorrhea. In many instances amenorrhea is dependent on an undeveloped or small uterus, referred to in young girls as an infantile uterus, and in older persons as premature atrophy. Starting from the rational idea that such uteri demand exercise, Carstens[240] suggests the use of a stem-pessary, which irritates the uterus, causing it to contract as if to make constant efforts to expel the contents. Within a year the uterus by such exercise will attain a normal size and the menstrual function will be regularly established. Dysmenorrhea may also be provoked by insufficient uterine exercise, and the stem-pessary is especially indicated when no special pathologic condition for the dysmenorrhea can be demonstrated.

Carstens observes that it probably makes no difference what kind of stem is used—rubber, glass, or metal. He prefers the rubber (Chambers) pessary. It is painful to introduce. The uterus must be dilated; if there is diseased mucous membrane, it needs curetting, and, therefore, it is necessary to give an anesthetic, as a rule. He keeps his patients in bed two or three days, and then they can get up and be about at their usual vocation.

If the stem is put in alone, it will often be forced out sooner or later, so he puts in a Hodge-Thomas pessary to throw the uterus forward and thus prevent the stem from coming out. It is not necessary to do this in all cases, but it is best, as a rule. If there is discharge, he has them use douches, but ordinarily this is not needed. He never takes out the stem and reintroduces it. He leaves it in sometimes two or three years without trouble. His patients travel all over the country, to Europe, and he has never had any trouble except in one case, in which pain suddenly developed, and he telegraphed the physician to remove it, the patient being near Boston at the time. In one or two instances the patients insisted on having the instrument removed too soon, and it had to be reintroduced. This was his earlier experience. Now he does not take them out sooner than three or four months, and six months or a year is a great deal better. They absolutely cause no pain and distress, and women do not know they wear them unless they are told.

The greatest precautions must be taken in excluding cases of inflammations of the tubes and ovaries and pelvic inflammations in general, because latent cases of tubal or ovarian abscesses may be lighted up by the introduction of a stem-pessary and serious consequences ensue. If adhesions have taken place and the uterus is pulled down and dilated, rupture may take place of dermoid tumors, even of an intestine or of the bladder. In such cases, with amenorrhea or dysmenorrhea, an abdominal section or some other operation is probably required. The stem is not indicated there. The stem is simply for cases of slight troubles from the surgeon's standpoint, but most distressing to the patient and trying to the general practitioner. (*Vide* tamponade, page 665.)

PSYCHOTHERAPY.*

Dr. John Hunter affirmed that he was confident that he could fix his attention on any part of his body sufficiently long to create a sensation in that part. Professor Gates was able, by thinking intently of one of his hands immersed in a basin full of water and willing that the blood should flow there, to make the water overflow. Teachers of physical culture emphasize that very little exercise, with the mind directing it, will effectually rebuild the body. Professor Anderson, of Yale University, weighs the result of a thought's action. His subjects are placed on a muscle-bed, poised on a balance so that the center of gravity of the body is exactly over its center. When a student was directed to solve mathematical problems, the increased weight of blood at his head changed his center of gravitation and caused an immediate dip of the balance to that side. The student was directed to imagine himself going through leg-gymnastics. As the feats were mentally performed, one by one, the blood flowed to the limbs in sufficient quantities to tip the balance according to the movement thought of. Dr. Tuke claims: "There is no sensation, whether general or special, excited by agents acting upon the body from without, which cannot also be excited from within by emotional states affecting the sensory centers, such sensations being referred by the mind to the point at which the nerve terminates in the body." The influence of the mind on the body is illustrated every day by the introduction of some new fad or delusion in the treatment of disease. It is difficult to conceive that such results are effected by the mind as a simple thinking organ; on the contrary, the mind is psychodynamic, and must be regarded as a force, like heat, light, and electricity, which operates for good or evil on the bodily functions. Strong mental impressions may actuate disease, and even death, or they may act by curing disease. Joy and hope stimulate, whereas grief and despair depress, the bodily functions. Sutton presents the following facts, which are apposite in this connection:

1. Mental emotion may induce sickness or death even in persons of robust health.

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* Facts bearing on this subject are also discussed in Chapter I, under treatment.

2. The physical phenomena induced by such cause indicate a deep perturbation—vibration—of the nervous system, and are generally of a dynamic character.

3. Thought strongly directed to a part tends to increase its vascularity, and consequently its sensibility, and thought directed away from any part diminishes vascularity and lessens sensibility, especially when associated with powerful emotion (a key which unlocks Christian Science and other "fads").

Dr. Goddard avers: "The idea of disease produces disease in direct proportion to its definiteness and in inverse proportion to the strength of the idea opposing it." Paraphrased, this law signifies that if an individual has a definite idea of a disease and its manifestations, it is more likely that he will contract that disease than any other, and, conversely, if he has a vivid idea of a disease, and just in proportion as his mind combats the idea that he will contract it, to that degree is he likely to escape. An idea generates its actuality.

Hoffman contends that if an individual has only one idea, the latter will express itself in some kind of external motion. Man is not only an ideo-motor but an ideo-idea being. Thus, with two ideas, one can inhibit the action of the other idea.

I use the word *ideopath* to designate an individual whose apparently sole affliction is some morbid idea. His idea reacts on the feelings and becomes a source of acute suffering. Macbeth suffered acutely from an idea, when he asks the physician whether he could

> " Pluck from the memory a rooted sorrow,
> Raze out the written troubles of the brain."

Emerson portrays the ideopath in the following quatrain:

> " Some of your hurts you have cured,
> And the sharpest you still have survived,
> But what torments of grief you endured
> From evils which never arrived."

Much of the mind's activity is suggested thought, or unconscious thinking, which is uncontrolled by the will. Thought, like force, pursues the path of least resistance, and with the repetition of thought a habit is engendered which eventually so masters the mind that the idea becomes pathologic, and is awakened into activity by the most trivial suggestions. Anomalous ideas are often created from long-forgotten images and are called into activity by some profound emotion or suggestion. Morbid fears are characteristic of nerve-exhaustion, for fear and weakness are associated conditions. Conscious strength is tantamount to courage, weakness to fear. A neurasthenic recognizes the absurdity of his fears, and may be able to dispel them. Fears are common among intellectual neurasthenics, and are often associated with indecision, doubt, eccentricity, vertigo, diminished affection for those dear to them, obsessions, etc. Looking inward into one's self is introspection. When we watch a mental process we introspect, and we introduce into such an observation a new element, which conflicts with that which we are watching. Persistent occupation with the phenomena of self is always achieved at the expense of less selfish interests, and eventually develops exaggerated idea-impressions centered on consciousness. An individual of this kind may be called an *ego-path*. He suffers from the inability to forget himself. Morbid introspection is an early sign of nerve-exhaustion, for the mechanism involved in conscious attention is easily tired. To study an unhealthy mind we must approach it by a correct study of the body, for a healthy mind without a healthy body is inconceivable. Diseases are so closely related that the physician is constrained to admit that they are often a posy of flowers modified only by the mental soil from which they were gathered. Dr. John Hunter said: "As the state of mind is capable of producing a disease, another state may effect a cure." When the mind is concerned in curing disease, the average skeptic refers the result to imagination, as though the matter deserved only contempt. Imagination is by no means the contemptuous process that is currently believed, for constructive imagination yields products necessary for material progress.

Tyndall uttered an important truth when he contended that while philosophers may be right in asserting that we cannot transcend experience, yet, gifted with the power of imagination, we can lighten the darkness which surrounds the world of the senses. Some one has said the more imagination possessed by a blacksmith, the better will he shoe a horse. Sir Benjamin Brodie observed that the correct use of the imagination, controlled by experience and reflection, becomes the noblest attribute of man, the source of genius and the instrument of discovery of science. A melange of imagination, confidence, and faith will nearly always yield the same therapeutic results independent of the method employed. Tuke quotes Pierre Ponponazzi, an author of the sixteenth century: "The cures attributed to the influence of certain relics are the effects of the imagination and confidence. If the bones of any skeleton were put in the place of the saint's bones, the sick would none the less experience beneficial effects, if they believed they were near veritable relics." Eastern religions taught that matter was subservient to mind, and the history of religion adduces many instances of mental healing. Elijah healed the dead child by stretching himself upon the body and calling upon the name of the Lord. The kings of England and France restored health by the laying-on of the hands. It is wrong to assume that mental influences are strictly limited to the treatment of functional disturbances. Even in organic affections the suggestion of hope is in itself sufficient to induce the physician to make many energetic efforts in diverse ways to gain the confidence of the patient's reasoning or conscious mind, so that the subjective mind, which controls most of our bodily functions, and is equally controlled by the objective mind, may be influenced. There are many physicians whose mannerisms in the presence of the sick fully accord with their inauspicious prognostications, which discourage the patient and depress his spirits. To retreat from this professional dignity is regarded as a breach of etiquette. Herbert Spencer observed, "The first requisite to success in life is to be a good animal, and this observation is specially applicable to the physician, whose amount of cheer which he brings to his patient is naturally governed by his physique and vitality." When Sir William Gull was asked the two most important qualifications of the physician, he mentioned businesslike habits and tact. The famous English physician, Sir Edward Quain, when quite a young man was placed in temporary charge of a patient, and full of the weight of his unaccustomed responsibility, his countenance grew longer and longer. When he was leaving one day, the lady's husband followed him. "I greatly appreciate the anxiety you feel for my poor wife," he whispered, "but please don't let her see it again, for, after you had left the room, she asked me if you were the undertaker." An individual considers himself as sick as he thinks he is, and the charlatan thrives on the delusion. "No one," avers Lavénge, "can be a hypochondriac at pleasure."

Psychotherapeutic Methods.—Suggestion may be direct, indirect, or by hypnotism. "Whether the object of your faith is real or false," said Paracelsus, "you will nevertheless obtain the same effects." In his "Anatomy of Melancholy" Burton says, "All the world knows there is no virtue in charms, but a strong conceit and opinion alone forceth a motion of the humors, spirits and blood which takes away the cause of the malady from the parts affected." Physicians have heretofore pursued the subject of psychotherapy, or mind-healing, as mere dilettantes, thus bringing into existence pseudo mind-cures, notably Eddyism, which has been defined as "a mental accomplishment whereby an earache becomes a symphony concert, a broken finger a diamond ring, and a 'touch' an invitation to dine." The interest in the occult is dictated by the law of fashion, and it breaks out periodically in a new garb, only to be cast aside when the same law declares it to be no longer fit for wear. E. C. Savidge[182] formulates the following psychic factors in treating disease:

1. Separate the patient from the scene of his troubles as far as possible—even to the extent of new temporary sleeping and business quarters.

2. Restrict all discussion of troubles to the morning hours.

3. Occupy him with his periphery, by ordering Turkish baths, massage, shave, hair-cut, manicure, and have him arrayed in his best garb, etc.

4. Interpose some one disinterested in his sore thought between him and his conjugal or business partner.

5. Seek gentle exercise for his atrophied auxiliary faculties. All the play impulses, such as sports and games, are of this class.

Drugs act as admirable vehicles for suggestion. They must be new, expensive, and characterized by taste, appearance, or action. The average ideopath has familiarized himself with the conventional drugs. Similarly, physical and dietetic methods which are novel and recondite are equally suggestive. The psycho-therapeutic action of diagnostic apparatus cannot be ignored. At the same time, however, the physician may, by dwelling too long on the examination of an organ, create fixed ideas which graduate into obsessions, so that the patient carries an organ in his head, and, from the latter citadel, viscero-sensorial reflexes emanate.

Dubois, in his interesting work, "The Psychic Treatment of Nervous Disorders," makes the following pertinent observation: "The nervous patient is on the path to recovery as soon as he has the conviction that he is going to be cured: he is cured on the day when he believes himself to be cured." Dubois ignores the physical methods in the treatment of psychoneuroses and depends on suggestion alone. He appeals directly to the reason, and by logical means suggests how an amelioration or cure of the symptoms may be obtained. The patient enters into the confidential relation, and the psychic nature of the trouble is revealed, and from rational autosuggestions, based on a philosophic view of life, a cure results.

Now, in reading the work of Dubois one is at once impressed with the simplicity of the procedure. The practitioner who has tried such measures is equally convinced that all psychoneurotics are not tractable to such persuasion, and he is constrained to conclude that physical methods cannot be ignored as vehicles in psychotherapy.

An essential element in mind-cure is to give close attention to the buried life and to solicit the patient's disclosure of it. A judicious analysis of a false idea by the physician, and discussing it as though it were real, establishes confidence between physician and patient (this may be called the "confessional cure").

Munsterberg's tests for detecting crime may also be employed in eliciting the unexpressed thoughts of the patient which are responsible for his disease: The patient is requested to listen to a list of words, and as each one is pronounced, to respond instantly with another word suggested by it. Most of these words are entirely unmeaning, but mixed in with them is a certain number suggestive of the thoughts which dominate the individual and contribute to his mental malady. A number of the unmeaning words are first pronounced, and the exact time required to give a corresponding word carefully noted. This interval is found to be about the same in every case. But suddenly a word bearing in some way upon the thoughts is quietly introduced. If the word has no bearing on the morbid ideas, a quick response will be elicited, otherwise the patient responds with some word showing an association of ideas which will incriminate him, or else, instantly on his guard, he will hesitate perceptibly, considering his response, and this hesitation, repeated again and again in the case of each trap word, will be in itself convincing proof of the thoughts which all the while are uppermost in the mind. This method I have employed several times in eliciting a history of masturbation.

Freud's Method of Psychotherapy.—This method is difficult of application and only serviceable in individuals with a certain degree of character and education. Poor results are achieved in neurotic degenerates. All hysterical conditions are amenable to this method. The method is based on the supposition that hysteria can be traced to unconscious fixed ideas, and that by translating the unconscious to the conscious, the impulsions which dominate the patient may be eliminated. Freud holds that a sexual factor is concerned in causing hysteria, and that the factor in question arouses an emotion which is associated with some bodily or verbal expression. The original emotion may pass from view, but the expression of the emotion lives and recurs in consciousness. Freud's method is as follows: The patient must completely relax in a suitable environment and with all sense stimuli excluded. With the hand on the patient's brow, the latter is urged to search the memory for any forgotten painful experience, notably that implicating sex. This method must be repeated several times. The patient never has imaginary diseases, although the imagination may create them. The judicious physician skilfully combines psychics and physics, and the unsuccessful physician is he who uses one to the exclusion of the other. Many ideopaths suffer so acutely that small doses of opium or codein are necessary before they can be made receptive to normal suggestion. Opium is one of our best mental anodynes, and the bromids, in sufficient doses, are good substitutes. When the physician is constrained to contend with mind and its vagaries, he cannot always "charm ache with air, and agony with words." Therefore we are often compelled to employ morbid thought anesthetics. The treatment of many ideopaths may be condensed in a word—*tact*. If direct suggestion is used, it is not only what, it is also how, when, and to whom you suggest. Suggestion by the adroit produces physiologic, and by the indiscreet physician toxic, effects.

If the ideopath be a real or supposed sufferer from heart disease, it is difficult for the physician to inoculate a good idea for a bad one, unless he adds cogency to his suggestion by demonstration. If he makes the patient do some forcible exercise like running up flights of stairs, and then assures him that unless he had a strong heart such exercise would be impossible, he has demonstrated that actions speak louder than words. Physicians misconstrue the significance of murmurs, and the patient suffers accordingly. In my book on "Diseases of the Heart" (page 30) I say: "No fallacy in medicine has been more carefully nourished than the belief that a cardiac murmur is always indicative of heart disease. Some of the most serious heart affections are unaccompanied by murmurs." I test the competency of the heart muscle and disregard the murmur for purposes of prognosis; and the pursuance of this practice has given mind-ease to many a cardiopath. In all heart troubles I make the prognosis as auspicious as reason will permit, but treat them as though my gravest suspicions were realized.

If a patient fears he has Bright's disease, and there should be albumin in the urine, he must be assured that the latter is without significance if you can show him that the kidneys functionate adequately as filters. After all, this is our true criterion in prognosis, and not the quantitative estimation of albumin. A patient who fears that he does not digest his food can often be convinced to the contrary by putting him on a test meal and then washing out his stomach. Again, if the trouble be nervous indigestion, and you can convince him that there is no anomaly in the chemistry of digestion, by an examination of the stomach contents, you have accomplished a great deal in the way of treatment, for that very patient will then pursue a method of correct living to attain nerve-health. In hysterical loss of voice, ask the patient to cough, and if the latter is louder in proportion to the voice, you will have demonstrated that one is no more attainable than the other. The use of electricity aids in enforcing the suggestion. H. W. Loeb[138] successfully treated many hysterical affections of the larynx by first impressing the patient with the gravity of the affection, and that absolute relief will be obtained by an operation of some severity.

The patient is told that he will be able to speak the word "home" immediately after the operation. Placing the patient on a chair, the index-finger of the right hand is introduced into the pharynx and the epiglottis pressed down until the patient becomes somewhat uncomfortable. After withdrawal of the finger the patient is told in a loud commanding voice to say, *home*, *home*, *home*. The patient responds as often as is necessary, until not only this but other words are pronounced. A single treatment may cause complete return of the voice. Dr. Tanner, says Tuke, treated successfully fifty cases of hysterical aphonia by electro-magnetic treatment of the tongue, but before using treatment the patient was persuaded that *he would be cured.*

Dr. H. T. Patrick,[134] of Chicago, adopts the following method with the patient who says he does not sleep: He instructs him to go home and stay up all night, and report to him the following morning. He does so, perhaps not having slept at all. He then instructs him to stay awake all day and the following night, and he usually finds he is unable to do so. When such a patient finds that he cannot absolutely stay awake for two nights in succession, he will make up his mind that he is not going to die from loss of sleep. I adopt the following method to convince patients suffering from insomnia (fake insomnia) that they really get more sleep than they think they do: I tell them to have at their bedside paper and pencil, and each time they are awake for more than an hour to make a mark on the paper. Either the monotony of effort in making the record, or because they really get more sleep than they think they do, appears to have an excellent effect on such patients.

Diversion.—In adopting any of the following methods the patient, if possible, should be placed in a new environment, under the care of a qualified nurse and physician. Hall[340] has recently established a practical shop for the manufacture of pottery and for the production of a variety of fabrics by means of hand-weaving. This method of occupation is suggested by Hall for the neurasthenic state or for any one who for reasons of mental and nervous hygiene might need to change his habits of life. Excellent results have been achieved.

As a means of substituting good for bad ideas, diversion is an excellent method. Pleasurable exercise creates objectivity, and the latter is the antithesis of self-consciousness. Diversion is practically an "*occupation-cure,*" and when physical strength permits, a "work-cure." Some patients have such an exalted opinion of drugs that the occupation-cure is best attained by having them take their medicine every ten minutes, or by the alternate employment of gargles, liniments, etc. It is well to remember, let us say, in the use of a liniment, not to apply it to the part affected, but at some remote point, with the object of directing the patient's mind away from the seat of his disease. If the patient has faith in physical remedies, massage and electricity are valuable aids, even though Moebius tells us that four-fifths of all electrical cures are dependent on mental influence.

The rhythm of physiologic functions permits of a maximum amount of exercise being taken in the early morning hours. Attention is one means of knowing whether the object pursued is interesting, for if it fails to incorporate the latter feature, it only adds to the mental burden. Yet attention in the ideopath must be cultivated, and to those who have it not I say, "You must cultivate it: it is so much medicine necessary for your well-being." I make them paraphrase page after page of some interesting work on psychology, like "Talks on Psychology and Life's Ideals," by James, a book that inculcates the principles of healthful doctrines. It is surprising to note with what eagerness intelligent patients pursue such subjects and how rapid becomes the mental transformation.

A certain invalid gentleman amuses himself without assistance and obtains intellectual exercise as well by the following device: He reads Henry James's latest novels and keeps a bridge-marker meantime. If Mr. James has a sentence which he understands, he gives a mark to himself; if, on the contrary, he meets a sentence which beats him, he gives a mark to Mr. James. In this way every sentence must be analyzed, but the invalid declares it is capital exercise.

In many instances good mental sustenance is derived from religious readings. Robert Louis Stevenson said: "If your religion makes you gloomy, you may be sure it is wrong."

The Emotional Life.—Emotions are often expressions of fatigue, or are fatigue-producing, and must be suppressed as a necessary condition of psychic health. Mary Lawson Neff[185] says: "The law that makes one kind of activity largely preclude another must be utilized in checking emotion. Work is the panacea for grief, and distraction is the balm for care." Emotion may be suppressed by education; it is too great to be wasted on ordinary occasions. The Lange-James theory refers the origin of our emotions to an organic disturbance reflexly aroused by the stimulus of the object; in other words, it is not the object, but the bodily commotion which the object excited. Thus, if the organic disturbance were suppressed, we should not feel fear so much as regard the situation as fearful. As James says, "One's personal self-discipline bids us pay primary attention to what we do and express and not to care too much for what we feel." Expressing one's anger in tears only accentuates the inner grief. "Refuse to express a passion and it dies," says James. Count ten before venting your anger. I heard one of my patients, who was a master of self-control, say that he thanked God that he once experienced an emotion.

Pershing[341] speaks of his method of controlling hysterical attacks, which are exaggerated emotional disturbances whose motor reaction is largely in the voluntary muscles, especially those of respiration. If the patient observes the first premonition of the attack, she will note that respiration is becoming rapid, shallow, and jerky. Now, by sheer force of will the respirations can be made slow and regular. When the latter is accomplished, then attention must be directed to the contracted voluntary muscles, which must be voluntarily relaxed, and then the breathing is attended to again. Pershing says that the faithful performance of these instructions will stop any ordinary attack, especially if reassurance in adults or the promise of reward in children be skilfully combined. Fear may be overcome by education, just the same as the driver of a balky horse gradually exposes the animal to anything which causes fear. One of my neurasthenic patients who feared high buildings overcame the morbid sensation by ascending high buildings daily in an elevator.

The Gospel of Relaxation.—Definite muscular movements will arouse definite muscular sensations. One of my nurses designated the following method, which I adopted in the treatment of ideopaths, as the "laughter-cure." Every hour the patient is instructed to smile for at least one minute, and every two hours to laugh audibly for the same length of time. Not infrequently the patient treated his idea, like the method, as positively ridiculous, and he soon laughed himself into recovery. Oliver Wendell Holmes said: "A smile may be worth (to the doctor) 5,000 dollars a year"; but it is worth a great deal more to the patient. Certain actions will arouse definite sensations, and by controlling actions one can indirectly regulate the feeling. If we conduct ourselves in a cheerful manner, our feelings will be in accordance with our manner. I can always tell when one of my friends is angry, for he whistles or sings only when in this state. He tells me that music creates new thoughts which are inimical to bad ones. It is said that the Englishman takes his pleasures sadly, which is equivalent to saying that he wastes no unnecessary energy. Another friend always speaks in a low tone of voice when he is angry, for then he makes the least demand on his nerve-force. To conquer unpleasant emotions one must wear a cheerful air, which reacts on the feelings. In "Power Through Repose," by Annie Payson Call, one finds much that is useful for the person with disordered nerves. One is advised never to resist a worry, for it is many times increased by the effort to overcome it. By relaxing the muscles, and so quieting the nerves, one may ignore the worry and it soon disappears. It may take some time to learn how to relax, but once learned, it becomes a habit. Habit in itself is a great economizer of nerve-force. It is automatic action reducing cerebral participation to a minimum.

Concentration.—This is an excellent method of controlling morbid ideation. To practise this method, thought should first be directed to some part, say the little finger. According to the power of voluntary attention, all sensations may be experienced, ranging from a sensation of heaviness to actual pain. When perfect concentration is attained, the respiratory rhythm becomes slower and slower and may even cease. Dr. Lewes observed: "To acquire the power of attention is to learn how to make our mental adjustments alternate with the rhythmic movements of respiration." The mental healers avail themselves of this psychic force of attention by directing thought away from the afflicted part. Attention is the essence of intellectual power. Strong emotion, associated with a fact, creates a more powerful impression on the mind.

Expectant Attention.—Lotze affirms that our apprehension of the world is one prolonged deception, and Taine asserts in his book on "Intelligence" that all perception is hallucination, although in some instances it may be shown to be true. What we perceive frequently depends on what we expect to perceive. Braid discovered that, by expectant attention, he could make patients see flames issuing from a magnet in a dark room, even though no magnet was present. Slate writers and spiritualists depend largely on expectant attention in the consummation of their trickery. Suggestion influences perception, and attention not only exaggerates, but actually creates sensation. Pilgrim advises in using any therapeutic measure to tell the patient what will not happen rather than positive affirmation. Impress upon the patient the *nots* instead of the wills. Thus, in using electric treatment for sciatica, say the pain will not recur so quickly or with so great intensity after as before treatment. This method is effectual in the "pain habit." It is true that mental healers succeed in ridding the patient of some persistent pain. Such pain is merely memory pain, a veritable psychalgia. Queen Mary of England was most anxious to have a son by her consort Philip. She soon developed all the signs of pregnancy, and even had labor pains, but when the fictitious pains disappeared, and she was informed that no pregnancy existed, she became hysterical, and Philip deserted her. The physician who hesitates is lost, for two reasons: by suggesting lack of confidence to the patient and to himself. Any task is easier of attainment if the subject autosuggests certainty of its fulfilment. An idea may so influence sensation that normal may be interpreted as abnormal sensations.

Schofield[136] speaks of the therapeutic power of a striking mantelpiece clock. He tested the value of the latter in two hundred uncomplicated cases of labor. He found that by impressing the patients with the fact, in cases where uterine contraction was irregular and slow, that a contraction would begin every five minutes by the watch and last two minutes, that such contraction did occur, as a rule, when so predicted. As a bowel regulator time is an invaluable expedient. The sufferer from constipation, if directed to go to the toilet at a definite time each day, and at no other time, notwithstanding the inclination, may soon establish the habit of securing bowel relief.

It is interesting to briefly refer to the observations of Sherrington, who demonstrated that in monkeys, when paresis of the limbs had been induced by ablations of the Rolandic area, post-hemiplegic rigidity and atrophy could be retarded indefinitely by passive and active exercises of the limbs implicated. Re-education of movements and therapeutic suggestion are of value even in organic paralyses. In employing the latter, predicting what will occur will establish confidence. In the natural course of events recovery from an organic paralysis begins in the leg before the arm; the hip and knee before the ankle; the shoulder sooner than the elbow, and the extensors of the fingers are the last to be restored. Movements most specialized and least associated with movements of the corresponding limb are the last to be restored to power.

Coercive Measures.—D'Israeli relates the story of a mad doctor of Milan who was celebrated for curing lunatics and demoniacs by immersing them in water as cold as ice. The patients in their bodily pain appeared to have forgotten their melancholy; thus by the terrors of the repetition of cold water a man appeared to have been frightened into his senses. I have read somewhere that an effective method for curing incontinence of urine in children was to have the latter, before retiring, stand in a tub, and from a large pitcher to pour cold water down their backs. I found this to be an excellent method so long as the little patients feared the cold water, and I therefore concluded that it was the fear that explained the action of the cold water. Adopting this method among certain nervous patients who would become hysterical with or without provocation, I found it equally effectual. As a routine measure, my method is to put the patient in cold-packs as often as necessity demands. In more intractable cases I use the cold-water bath just as we do in typhoid fever, every three hours or oftener, until the nervous paroxysms are subdued. The patients must, of course, be stimulated before entrance into the bath, and all the other necessary precautions must be taken. I am an ardent advocate of a bath of about 95° F. for thirty minutes or even longer for sedative and hypnotic purposes in nervous individuals. Lately I have seen four patients, two in consultation, who were unusually noisy and practically suffering from acute insanity. They had resisted all the usual methods of treatment. When told in a gentle though firm manner that they would have to be sent to an insane asylum unless they improved at a certain hour, they all became tractable within the time limit, and three of them recovered completely. I do not know the fate of the fourth patient. Thus fear may prove a mental tonic by its judicious employment. In some instances physical pain may be provoked as an antidote to many forms of psychic depression, and a good blister or seton is worth more than all the drugs of the pharmacopeia and all the philosophy of ages. The patient is a mixture of impulsions and inhibitions, and just as we inhibit an unruly heart by digitalis, so may we call forth the inhibitions of a delirious brain. Dr. Gilbert washed a boy's hands covered with warts in blue water, telling him that if in a week they had not disappeared, he would use yellow water, which the boy imagined would scald him. At the end of the week all the warts except two or three had vanished. In England mesmerism was thus satirized:

THE WONDER MAGNETIC ELIXIR.

Take of the chemical oil of fear, dread, and terror, each...	4 oz.
Of the rectified spirits of imagination....................	2 pounds.

Put the ingredients into the bottle of fancy, digest, etc.

Hope and fear must be employed with discretion. Too much hope encourages apathy in the employment of measures necessary for recovery. Operative procedures, or even their mere suggestion, have frequently resulted in cure of obstinate cases. Very often the operation itself in epilepsy seems to have a curative effect. Thus J. William White trephined in fifty cases of epilepsy in which nothing abnormal was found to account for the symptoms, yet twenty-five were reported as cured and eighteen as improved. Even indifferent operations at points remote from the skull effected the same results. Numerous supposed uterine diseases have been cured by abdominal section, or by the anesthetic alone and the idea of abdominal section.

Hypnotism.—Space will not permit a discussion of this subject beyond saying that I prefer not to employ this method if I can help it. Hypnotism can never take the place of normal suggestion. Yet hypnotism has proved effective in some ideopaths, when other methods failed. I may also add that even though some ideopaths were brought into a state of deep hypnotism, I was unable in any way to influence their morbid thoughts. I agree with Bernheim, who says: "It is the duty of the physician to select what is useful in suggestion and to apply it for the benefit of his patients. When in the presence of sickness I think that therapeutic suggestion has a chance of success, I should consider myself to blame, as a physician, if I did not propose it to my patient, and if I did not even make a point of getting his consent to its employment."

I have read a book by Henry Wood on "Ideal Suggestion Through Mental Photography." This writer, who impresses one as being very sincere, asks the reader to retire each day to a quiet apartment, and be alone "in the silence." He must assume a restful position in an easy chair, and thoroughly relax the physical body to make the mind passive and receptive. "Bar," he says, "the door of thought against the external world and shut out all physical sensation." The reader is then asked to rivet his mind on certain placards in very large type contained in the book, which read variously, such as: "Pain is friendly," "Mental healing is scientific," "I am healed," etc. He advises attention for from ten to twenty minutes at least until that time when the words fill and overflow the entire consciousness. Then the eyes are closed for twenty minutes longer, until the words enter the mind's eye and permeate the whole organism. The words must be recalled into the field of mental vision during every wakeful hour of the night. This exercise is to be used daily. The foregoing is quoted merely to show the variety of the mental methods adopted in the treatment of disease, and that by automatic repetition of almost anything the subject will eventually believe it, just like the liar, who soon becomes convinced of the reality of his own prevarications.

Religious Therapeutics.—This, unlike Christian Science, is an attempt to conciliate the forces of medical science and the religion of the New Testament. Here suggestion, psycho-analysis, and ethical and religious appeals are made to induce individuals to surrender hurtful and disadvantageous habits and to create health-provoking ones. In this Christian psychology the theologian cooperates with the physician, and nothing is done without the advice of the latter. This new crusade is arousing national attention, and will, no doubt, prove a notable factor in the treatment of many psycho-neuroses.

Dejérine employs "**persuasion**" as a very essential part of the Weir Mitchell treatment, and recourse is only had to overfeeding in cases of emaciation. Persuasion is practically mental treatment administered during isolation by the physician, and suggestion as understood by Charcot is not employed. The patient receives rational explanation of his condition and he is made to co-operate intelligently in his own cure.

Metallotherapy.—It has been found that in hysteria the application of certain metals or a magnet will transfer anesthesia or analgesia to the other side of the body. This phenomenon provoked much discussion until it was demonstrated that wood or any indifferent object would accomplish the same effect, hence the transference is regarded as essentially psychic.

Scopolamin Anesthesia.—Berillon[157] employs scopolamin in non-hypnotizable subjects. Passiveness is indispensable for hypnotic sleep to take place, and to procure this, various observers have used small doses of anesthetics or narcotics. Narcotics are often long in acting, and it is difficult to hit off the right moment for suggestion, and the succeeding period of somnolence is of more or less long duration. Scopolamin, however, produces a state of inhibition analogous to that observed in deep hypnotism in about thirty minutes after an injection of 0.3 to 0.4 of a milligram. The patient resists for a time, rubs his eyes, blinks, wants to lie down, the eyelids droop, and he sleeps. Respiration is quiet. The arm when raised has a tendency to remain in that position, as in hypnotism. A loud voice, or speaking loudly, or moving the patient wakes him just as from ordinary sleep. There is loss of sensation to pricking or pinching. Suggestions made in this state are realized after awaking, as in hypnotism. All care should, however, be taken, as the drug is highly toxic.

Link[158] found the *Babinski reflex* present in thirty-seven out of forty-three patients to whom scopolamin had been given, even when the injected dose did not exceed 0.0004 mg. The presence of the reflex indicated that the drug had become effective. The reflex in question consists of a dorsal extension of the great toe instead of plantar flexion in the norm when the sole of the foot is irritated. It has always been regarded as pathognomonic of lesions in the pyramidal tracts, but it has also been found in comatose states, epilepsy, and meningitis.

Diagnosis.—From what has preceded it is evident that many diseases are mental, not physical anomalies, and it is equally true that many physical affections develop a psychic coloring. An important factor in treatment is moral control, and this is often impossible of attainment unless the patient is isolated. The rest-cure is an excellent excuse for taking the patient away from sympathetic and loving relatives.

The peculiarity of hysteria, according to Babinski, is that its manifestations are capable of being reproduced by suggestion in certain subjects, and can be made to disappear under the exclusive influence of suggestion or, as he calls it, persuasion. Thus, whereas the hysterical symptoms really result from auto-suggestion, non-hysterical phenomena cannot be reproduced, and if an imitation is obtained, it is very imperfect, and can easily be distinguished from the original. It is of great importance to recognize hysteria as well as a number of other affections as mental diseases, for by so doing normal suggestion or hypnotism may effect a rapid or even an instantaneous cure. If unrecognized, the patient is destined to become a chronic invalid. Babinski suggests the word "Pithiatism" to indicate diseases cured by persuasion. Moebius taught that all symptoms should be regarded as hysterical which can be voluntarily produced or simulated. Thus, there are many symptoms which can neither be willed nor simulated, hence their occurrence speaks for organic against functional diseases of the nervous system. Among the unwilled phenomena are: lost knee-jerk, reaction of degeneration, Babinski toe-sign, changes in the optic nerve, hemianopsia, pronounced pupillary changes, unilateral vocal cord paralysis, facial paralysis, incontinence of urine and feces, and ankle clonus.

Now, if we accept Babinski's interpretation of hysteria, one does not go very far astray in regarding all affections engrafted on auto-suggestion as hysterical, or at least hysteroid. Thus, we can exempt no period of life as immune to auto-suggestion. Authorities recognize a juvenile and even an infantile form of hysteria, and some, like Bruns[139] and Briquet,[137] reckon the ratio of juvenile to adult cases of hysteria as one hysterical child to five hysterical adults. It is believed that the uneducated child of poor parents is even more vulnerable than the intractable child of parents in affluent circumstances. Childhood is the period of mimicry, and the latter invites many morbid impressions. The hysterical syndrôme of the adult is made up of a multitude of symptoms, whereas in children the affection is monosymptomatic, or, as D'Orsay Hecht[138] puts it, in an exhaustive contribution: "A single hysterical symptom, standing out in bolder relief in the child than it would in the adult, should from its very prominence arouse a suspicion as to its functional nature." Monoplegias, paraplegias, and hemiplegias occur, and are characterized by their sudden development and rapid fluctuations respecting amelioration and retrogression. The various tics of childhood, epileptoid seizures, and choreic movement in children are frequently hysterical. Slight causes for severe affections must arouse the suspicion of hysteria in the child as well as the adult. The dictum, *tuberculosis primis in stadiis semper curabilis*, applies with equal cogency to hysteria; an early diagnosis postulates a cure if an effective psychic treatment is supplemented by isolation. Two methods are advocated by Bruns[139] in the hysteria of children: (1) Method of surprise. (2) Method of disregard. In the first method an attempt is made to emancipate the child from a deep-rooted obsession. The child is given no time to reflect, or otherwise it signifies certain defeat for the cure. A child is put into a bath-tub and the cold water is suddenly turned on, and very often the child who was unable to walk, suddenly remembers that the feet can be put to good use by hurrying away from the scene of discomfort. Recourse is had in intractable cases to raising the child and then letting it drop to the floor, and then, when the child is still overcome by fright and surprise, to assure it that, being able to stand, it is able to walk.

By the method of disregard the physician and the attendants carefully observe all the symptoms at a distance, but remain utterly indifferent toward them. In this way the patient, finding that the symptoms are slightingly regarded, soon accords them the same disregard, and they evanesce. Hecht cites a method of cure in a hysterical child aged four with astasia-abasia, *i. e.*, inability to stand or walk. For the first two days the child was practically starved, and then far from her bed was placed a bowl of milk-toast, toward which she quickly walked and hurriedly devoured it. Jacoby[140] regards electricity as one of the most efficient carriers of suggestion, and considers that when a symptomatic cure has been effected by electricity alone, the cure is due to suggestion and not to the electric current.

Hypnotism in Diagnosis.*—Charcot's division of hypnosis into three stages is of historical interest only, and is now regarded as artificial and provoked by suggestions on the part of the operator. The stages are: (1) Cataleptic, developed by a sudden noise or by artificial opening of the eyes of the subject by the operator: there is a peculiar rigidity of the muscles (*flexibilitas cerea*), which enables one to put the limbs in any posture where they will remain fixed until the position is again changed. (2) Lethargic, in which suggestions are not received by the subject. (3) Somnambulistic, by rubbing the vertex of the head; mere rubbing of the skin causes contraction of the underlying muscles, and the same maneuver will cause the latter to relax. Suggestions in this stage are accepted. Psychogenic pain may be made to disappear by verbal suggestion plus the application of the warm hand to the part. In painful affections of the joints Grossmann pinches the skin and suggests that the pains will be transferred from the joints to the skin. In many instances immobile joints in the hysterical subject may be made to move again. Hirschlaff[331] employs hypnotism in differentiating the convulsions of hysteria and epilepsy. Whenever the phenomena of the somnambulistic stage can be provoked, the subject is hysterical and never epileptic. Hysterical paralyses and contractures are amenable to cure by hypnotic suggestion, and the same may be said of many neuroses. Cardiac neuroses are especially amenable to hypnotic suggestion, and in many instances I have been able to reduce a rapid pulse and secure a cessation of palpitation and cardiac pains. Above all, one can suggest the absence of an organic cardiac affection, which is of the greatest importance in cardiophobia. As a rule, when a given symptom fails to be influenced by hypnotic suggestion its functional origin should be questioned.

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* During hypnosis, many important facts concerning the patient's illness may be elicited from the subconscious mind which in consciousness cannot be recalled. Many symptoms of functional diseases are amenable to suggestion during hypnosis and in instances where functional are associated with organic symptoms, hypnosis by eliminating the former permits one to gage the organic factors in the symptomatology.

PSYCHROTHERAPY.

It is now about twenty years since I made my first contribution on the subject of freezing as a diagnostic and therapeutic agent. For this purpose I employ rhigolene, although ethyl chlorid, now procurable in tubes, is equally efficient, though more expensive. In an emergency the skin may be frozen by the aid of two parts of pounded ice and one part of salt mixed together and applied in a rubber bag until the skin becomes white and hard. A piece of ice dipped into common salt and then held to a part will freeze the skin in a minute or two. Ether may also be used as a spray for freezing, but all preparations are not equally reliable. In the event one has an inferior preparation of ether, the latter is effective if freezing is first done with *ethyl chlorid*, then with the ether freezing may be prolonged *ad libitum.* The latter fact is of importance for economic reasons. It is cheaper than rhigolene. I have attempted by theory and experimentation to evolve the rationale of congelation. The following hypotheses are presented:

1. Freezing may act as a counterirritant. This is contravened by the fact that freezing, unlike counterirritation, is immediate in its action, of greater potency, and followed by slighter reaction.

2. Freezing may act by producing physical changes in the underlying structures. Repeated histologic examinations which I have undertaken show no degenerative nerve changes after the conventional clinical application of freezing, and it is only when freezing is carried to an inordinate degree that such changes can be demonstrated, not only in the nerves, but also in the superimposed tissues.

3. Freezing acts as a shock by inhibiting the nerve functions for a variable period. I am inclined to accept this final hypothesis.

Diagnosis.—Reference has already been made to spinal massage (page 564). For locating the sensitive vertebræ, I employ the hammer and pleximeter referred to elsewhere (page 291). The spine of each vertebra is lightly percussed in turn, and when a sensitive point is attained, it is marked by a dermograph. In practically all cases, when a sensitive vertebra is found, the *points douloureux* of Valleix are present. These points are of great importance in diagnosis, and are limited spots of tenderness found somewhere in the course of distribution of the spinal nerves after exit from the vertebral column. Freezing is generally done to one side of the vertebral column, at the points of exit of the sensitive nerves. Freezing must be thorough, and although I have employed the method thousands of times during the past twenty years, I have never witnessed untoward symptoms.

Inflamed are less readily frozen than normal tissues. The skin assumes a snow-white appearance and becomes very hard when freezing is thorough, and this condition should be maintained for thirty or more seconds. The frozen point may be properly protected by lint and the process may be repeated on successive days. The conventional freezing of the skin may be intensified in intractable cases by a modification which I have denominated reinforced freezing. It consists of injecting sterilized water beneath the skin, over the part to be frozen or directly into the tissue until an appreciable bulging is produced. If the spray is now directed on the protuberant part, a lump of ice is formed under the skin or in the tissues.

Differentiation of *neuralgia* of central and peripheral origin is conceded to be a difficult matter. If a nerve, the seat of neuralgia, is frozen nearest its point of origin, the pain will disappear if the neuralgia is of peripheral, and persists if of central, origin. In the absence of spontaneous pain, the points of Valleix may serve as guides. If previously marked with a pencil, they will be found insensitive in peripheral neuralgia after freezing. In neuritis, as in neuralgia of central origin, the painful points of Valleix remain persistently sensitive. Neuralgia of an accessible nerve, treated by freezing near its point of exit, failing to yield to repeated freezing is not a veritable neuralgia, but a neuritis or complicated neuralgia. Cases failing to yield to congelation generally become chronic, for freezing is a specific for all forms of uncomplicated neuralgia. By means of reinforced freezing many cases of presumable neuritis were cured, but the primary statement refers only to the cutaneous congelation. Freezing is an excellent method of *localizing pains*. In evidence of this thesis the following are cited as paradigms:

1. Patient has a number of cicatrices on the scalp and com-

plains of pain. All the cicatrices are equally sensitive to pressure. Freezing at the exit of the occipital nerves in the neck is without effect. Then the individual scars were frozen during a painful paroxysm. Pain continued until one cicatrix in the occipital region was frozen, when it ceased at once. Patient objected to the removal of this cicatrix, which was recommended. Repeated freezing of the implicated cicatrix resulted in cure.

2. Occipital neuralgia with customary painful points. Freezing at exits of the nerves without result. During a paroxysm of pain each sensitive spot was frozen, and when one point was frozen the pain ceased. A small neuroma was present at this spot, which was removed.

3. Neuralgia of the trigeminus. Freezing during a painful paroxysm at the supraorbital, infraorbital, and mental foramina respectively. Relief from pain when congelation was conducted at the latter foramen. In the lower jaw a carious tooth was found, extraction of which cured the neuralgia. One must remember that in facial neuralgia teeth may be implicated which are apparently healthy. In such instances each tooth should be tapped in succession or subjected alternately to hot and cold to reveal the tenderness of an irritated pulp.

It is an indubitable fact, to which detailed reference is rarely made, that *intercostal neuralgia* may be accompanied by visceral symptoms of such prominence that the neuralgia is overlooked and treatment is directed toward the presumable visceral disease. Such cases, while presenting a varied clinical picture, are frequently analogous, if only atypically so, to gastric, renal, vesical, cardiac, and esophageal affections. In many instances the symptoms of neuralgia in the implicated nerves corresponding to the presumably involved viscus are either absent or incompletely pronounced. As a rule, however, vertebral tenderness corresponding to the exit of the nerves can be elicited, and when congelation is conducted over the site of vertebral tenderness during a paroxysm, the latter is nearly always inhibited. In the absence of tenderness congelation may be conducted for the purpose of excluding a neuralgic affection. It may be safely affirmed that tenderness of the scalp or thoracic or abdominal parietes is dependent, as a rule, not on visceral disease, but on a neuralgic affection of the cervical or dorsal nerves.

Many cases of *pseudo-visceral disease* can be partially explained by the anastomosis existing between the spinal and sympathetic nerves as well as by the concomitant symptoms of intercostal neuralgia. One dare not report phenomenal cures in this epoch of therapeutic skepticism without being accused of extravagant representation, misinterpretation, or auto-suggestion, hence in this regard I will be extremely brief. Many years ago I contributed an article on *pseudo-appendicitis*, in which I attempted to show that the condition was dependent on a neuralgia of the lumbo-abdominal nerves, and that, further to complicate matters, the neuralgia was often accompanied by a circumscribed spasm of the abdominal muscles in the ileocecal region. I then directed attention to the fact that these cases were amenable to prompt recovery by congelation of the sensitive nerves at their exit from the vertebral column. Even at the first freezing the pain, tumor, and sensitive points evanesced. One would naturally conclude that a skilled diagnostician could not possibly err in mistaking an appendicitis for a lumbo-abdominal neuralgia. In Paris I recently saw an American lady who was suffering from atrocious pains in the ileocecal region. She consulted some of the leading surgical and medical clinicians of Europe. All were unanimous in their conviction that she had appendicitis and that an immediate operation was imperative and the only means of arresting the pains. An examination demonstrated a spasm of the abdominal muscles in the neighborhood of the appendix, which at one point was so circumscribed as to awaken the suspicion of a tumor. A point over the appendix was exquisitely tender. There were the usual tender points elsewhere in the gluteal region, on the outside of the thigh, symphysis pubis, and at the vertebral exits of the nerves. A single freezing gave immediate relief, although about ten freezings were necessary to effect a permanent cure. These patients often suffer a relapse, especially in inclement weather, but a single freezing suffices to cure. My only excuse for citing the latter case is to illustrate the frequency of pseudo-visceral affections which are often erroneously interpreted by some of the best men in the profession.

I have also seen many cases of what I have called *pseudo-*

mastoiditis. An erroneous diagnosis is often made because the mastoid process shows a point of exquisite tenderness and the patient happens to have an affection of the middle ear. These pseudo forms of mastoiditis are merely cases of cervico-occipital neuralgia which yield to several freezings at the vertebral exits of the nerves. A single freezing will cause the disappearance of the sensitive point over the mastoid. I have also seen several cases erroneously diagnosed as gall-stone colic which were in reality only cases of lumbo-abdominal neuralgia, and which likewise yielded at once to freezing of the sensitive nerves at their vertebral exit. In the absence of a freezing material, counterirritation may be employed at the sensitive vertebral points, although the latter method is not as rapid nor as efficacious as congelation.

In *aphonia* caused by laryngitis, and in spasmodic laryngeal neuroses, freezing after the following method is almost instantaneous in its results: Mark approximately with a pencil on either side of the neck the point in the thyrohyoid membrane where the internal laryngeal branch of the superior laryngeal (the nerve of sensation to the larynx) passes into the latter organ. Over the points marked, freeze thoroughly.

In freezing *carcinomatous tissues* one can define the extent of infiltration: the healthy tissues assume at once a snow-white appearance, whereas the infiltrated parts take on this appearance more slowly and less completely. The foregoing fact is of importance in the treatment of neoplasms by curettage. Freezing is also of value when a section of tissue is desirable for diagnosis by an early microscopic examination.

Precordial Frigotherapy.—Leduc[226] observes that one may conveniently dispense with the cold baths in the specific infectious diseases by the application of ice-bags to the precordial region. Even at the end of two hours there is a reduction of one to two degrees of temperature and the pulse is reduced from 15 to 30 beats per minute. If the rapidity of the pulse is maintained despite the fall of temperature, it is an evidence that the infectious condition still prevails. The local application of ice also protects the heart against lesions which Leduc designates under the name "thermic myocarditis." He assumes that high temperature induces a coagulation of the myosin of the muscle. Precordial frigotherapy augments the sensibility of the organism to antithermic medication; thus, 50 centigrams of pyramidon, which exercises no influence upon the temperature of the disease, will provoke a hypothermy when frigotherapy is employed. In other words, the latter treatment enables us to diminish the dose of an antipyretic, which is of decided advantage to the patient.

Erythromelalgia.—This affection, also known as red neuralgia, is a chronic disease characterized by pain, flushing, and local fever of the hands or feet (usually the latter). The symptoms are more intense if the parts hang down. The affection may be confounded with Raynaud's disease, but in erythromelalgia the application of cold brings relief, whereas in Raynaud's disease cold intensifies and warmth relieves the symptoms.

PUNCTURE.

The technic of puncture has already been considered (page 170). Here brief reference will be made to its value in diagnosis. In the introduction of the needle one must not disregard the sense of resistance nor movements communicated to the needle. The aspiration of clear serum does not exclude pus, for the reason that purulent exudates show a tendency to sedimentation; hence, in doubtful cases, the puncture should be made as low as possible. A microscopic examination is always more important than a macroscopic examination in determining the nature of the exudate. In searching for bacteria in a serous exudate, the method of Ilkewitsch is indicated: The nucleoproteid is precipitated by the addition of acetic acid, and after further precipitation by the centrifuge, the sediment is examined microscopically. In addition to the latter examination, the culture method must be employed.

Fluid effusions may be due to passive congestion, as in cardiac lesions, or to defective drainage, as in renal lesions. Such effusions are dropsical, and are called *transudates*. When the effusion is the result of inflammation of a serous membrane, it is called an *exudate*. It is important in diagnosis to distinguish an exudate from a transudate. A transudate has usually a specific gravity of under 1.015 with an albumin percentage of less than 2.5. An exudate has usually a specific gravity of more than 1.018 and more than 4 per cent. of albumin. The proteid content bears an approximate relation to the specific gravity, hence by estimating the latter, the proteid content can be determined according to the following figures of Ruess:[141]

SPECIFIC GRAVITY.		PROTEID CONTENT.
1018	higher than	4.0 per cent.
1015	lower than	2.5 " "
1012	" "	1.5 to 2.0 " "
1010	" "	1.0 to 1.5 " "
1008	" "	0.5 to 1.0 " "

If one adds to the fluid a few drops of acetic acid and it becomes more or less turbid, it is probably an exudate; in transudates the turbidity is slight or absent.

Serous fluid of inflammatory origin clots on standing. Clotting may also occur in transudates if they contain blood. Two methods of investigation have recently been recommended in the examination of pleural effusions, viz., *inoscopy* and *cytodiagnosis*. The former is a complex process for the detection of tubercle bacilli in the fluid, and is essentially a laboratory method. Cytodiagnosis, on the contrary, is a valuable method in the diagnosis of pleural effusions and in determining their etiology. The scope of this work will not permit a detailed reference to this subject; suffice it to say that Widal has formulated the following cytological formulas:

1. When the lymphocytes predominate, the effusion is tubercular.

2. A predominance of polynuclear leukocytes signifies an effusion of acute infectious origin.

3. A large number of endothelial cells, especially when occurring in sheets, signifies a mechanical effusion or transudate.

The technic of cytodiagnosis is essentially as follows: The fluid is drawn into sterilized tubes. If the fluid is clotted when received for examination, it is stirred with a glass rod until the clot is thoroughly contracted, and the clot and other clots should be removed. The fluid is then centrifugalized for five minutes. Decant supernatant fluid. Mix sediment with a platinum loop and remove a drop and prepare a cover-slip smear. Allow specimen to dry spontaneously. Then employ Wright's stain. This stain colors red cells orange or pink; lymphocytes, dark purple-blue nuclei, and robin's egg-blue cytoplasm; polynuclear neutrophile leukocytes, dark blue nuclei and reddish lilac granules.

Pus.—Kolaczek and Müller[216] suggest a simple means of differentiating tuberculous from other pus as follows: a small but deep china dish is filled to the edge with Millon's reagent and a drop of the pus is deposited in the center of the surface; if a solid film forms over the surface of the reagent and the color of the fluid below is unaltered, the pus is tuberculous. Pus of any other origin forms no film and the reagent turns a bright red. Millon's reagent is as follows: Mercury 10, nitric acid (sp. gr. 1.185) 25 by weight, water 25. Dissolve in a flask at lukewarm heat, shaking often, and add to a solution formed by dissolving mercury 10, in nitric acid (sp. gr. 1.25 to 1.3) 22 by weight without artificial heat. This reagent gives a red color with proteids and most nitrogenous compounds in solution.

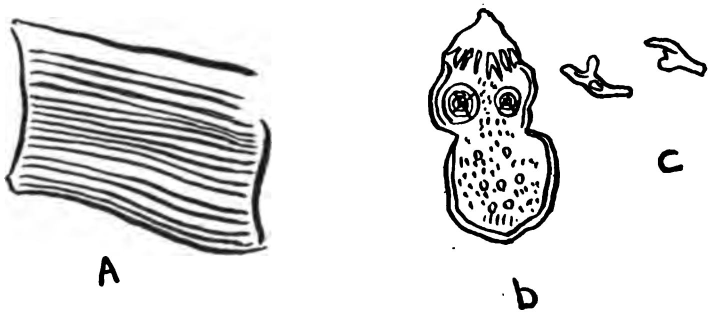

Fig. 82.—Echinococcus elements: *A*, Membrane; *b*, scolex (rostellum projected); *c*, hooklets.

Ascites.—A hemorrhagic effusion is frequent in cancer of the peritoneum and tuberculous peritonitis, and it is occasionally encountered in cirrhosis of the liver. Dock refers to the presence of endothelial cells with nuclear figures in cancer. A milky fluid may be due to fat associated with mesenteric or peritoneal cancer or to chyle (chylous ascites). The two forms are distinguished microscopically by the presence of fat-globules in the fatty variety. According to Osler, a strict milk diet, by causing an excess of fat in the blood (lipemia), may cause mild grades of chylous ascites.

Cysts.—These are usually circumscribed cavities containing gas or fluids shut off from the surrounding tissues by an independent wall. The essential elements are the wall and contents. From the nature of the epithelium lining the wall, it is often possible to determine the origin of the cyst. Epithelium is only found in cysts taking their origin from spaces originally lined with epithelium. Cysts are movable, elastic, circumscribed, fluctuating tumors.

Echinococcus Cysts.—The fluid is usually clear, with a specific gravity of 1.006 to 1.010. The microscope shows the presence of shreds of the cyst-wall, hooklets or scolices (Fig. 82). The fluid usually contains no albumin, and the presence of the latter signifies an inflamed echinococcus sac. The detection of sugar in the fluid is especially characteristic of hydatid cysts.

Gall-bladder.—Exploratory puncture of the bladder for detecting gall-stones is now rarely practised. Biliary coloring-matter and cholesterin crystals demonstrate that the cystic tumor is connected with the gall-bladder. If the latter is closed off, all the biliary constituents may be absent, although cholesterin is the most persistent constituent.

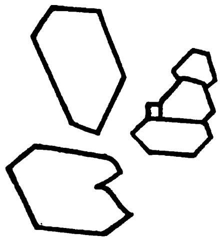

Fig. 83.—Crystals of nitrate of urea.

Kidney Cysts.—In cysts of the urinary system the Salkowski test for urea should be made: 100 c.c. of the fluid are neutralized with acetic acid and then poured into 400 c.c. of absolute alcohol. Shake and then permit it to stand for several hours, after which the coagulum is washed off with alcohol and the extract evaporated over a low flame. The residue is treated several times with absolute alcohol and the extract evaporated to dryness. To the residue add a few drops of nitric acid and then allow it to stand for twenty-four hours in a cool place. The crystals of nitrate of urea can be obtained from the sediment for microscopic examination (Fig. 83).

Mesenteric Cysts.—These may be dermoid, chylous, hydatid, serous, or sanguineous. They may be very small or large enough to occupy the entire abdomen. They are usually movable, situated in the median line, and covered by a zone of tympany. They are often mistaken for ovarian tumors, but the latter can be excluded whenever puncture can be made.

Ovarian Cysts.—Here the presence of paralbumin is characteristic, and the test for the same is as follows: Add to about 25 c.c. of the fluid a few drops of an alcoholic solution of rosolic acid. Then heat to boiling and add dilute sulphuric acid (tenth-normal solution) drop by drop until the fluid assumes a yellowish tinge. Then boil fluid again and filter; and if paralbumin is present, the filtrate will be clouded. Paralbumin (pseudomucin), unlike mucin, cannot be precipitated from the cyst fluid by acetic acid.

Pancreatic Cysts.—These usually cause a semicircular bulging in the median line of the upper abdomen. In sixteen cases reported by Körte, the bulging was below the navel. The cysts show no respiratory mobility. The fluid is reddish or dark-brown in color, alkaline in reaction, and with a specific gravity from 1.010 to 1.020. As the fluid contains ferments if recent, the test is to take a small quantity of egg-albumen and put it in a tube containing the suspected fluid. In three hours add to the fluid a drop of a dilute solution of sulphate of copper. If albumose is present, the fluid assumes a reddish-violet color (biuret reaction).

Joints.—Fluid may be aspirated from any joint for diagnostic purposes. Thus, the gonococcus may be found in the fluid and the nature of the trouble recognized. Puncture is usually confined to the knee. The needle may be inserted wherever the swelling is most pronounced. Care must be exercised not to injure the cartilage with the point of the instrument and rest in bed must be enjoined after the puncture. An intermittent articular dropsy may exist as an angioneurosis and is observed in many neuroses. Féré noted a painful swelling of the knee-joints in a hysterical morphin-taker during the withdrawal of the drug, which appeared daily at a certain hour, but which disappeared in a few moments after a hypodermatic injection of morphin.

Brain Puncture.—Several years ago Kocher advocated exploratory puncture of the brain through fine holes drilled in the calvarium. More recently Ascoli[265] relates the histories of six cases in which this method furnished important diagnostic information. The holes were made under cocain anesthesia by means of a dental engine.

Exploratory Drilling.—Plesch[266] advocates hollow drills for exploring bone and studying lesions of the bone-marrow.

Lumbar Puncture.—The technic and dangers of this procedure have already been discussed (page 172). The normal cerebrospinal fluid is a transparent liquid with a specific gravity of 1.003 to 1.004. The quantity is from 60 to 100 grams, which in the aged is often increased to 400 grams. The fluid escapes from the needle drop by drop, but when pressure is increased it escapes in a stream. Increased pressure is noted in brain tumors, in tuberculous meningitis, and in other severe inflammatory conditions. In coma from intracranial pressure, consciousness for many hours has been restored by lumbar puncture. According to Terrier, the symptoms of a basal fracture are temporarily relieved and violent pains always disappear. In noting the coloration of the fluid it has been suggested by Wentworth to compare the fluid with distilled water contained in another tube. The discoloration of the fluid may vary from cloudiness to a purulent turbidity. In chronic meningitis the fluid may be clear or of a greenish-yellow color. In tuberculous meningitis it may be clear or cloudy. In icterus it may assume a yellowish color. The spinal fluid in tuberculous meningitis, unlike the fluid in the norm, shows a tendency to coagulate when allowed to stand for a few hours, and, in a large percentage of cases (estimated at 75 to 90 per cent.), tubercle bacilli may be demonstrated in the clot, which is spread on a slide and stained after the manner of examining for tubercle bacilli in the sputum.

In the fluid withdrawn from hemiplegics, old hemorrhages are indicated by the presence of hematoidin and hemosiderin. The finding of the latter speaks for hemorrhage as against embolism. A basal fracture is confirmed by bloody fluid, which may be present also in hemorrhage within the arachnoid of the brain or cord.

The bacteriologic findings are often important. Thus, the finding of Weichselbaum's diplococcus intracellularis is diagnostic of cerebrospinal meningitis. It is not always possible to find tubercle bacilli by direct staining and culture, and inoculation methods must be employed. Insomuch as the latter require several weeks for the demonstration of the organism, they are not available for clinical purposes when an immediate diagnosis is imperative. Even inoculation is not always positive, owing to the fact that the meningeal tubercles have not disintegrated or because they are confined to the cranial meninges and the communication between the two cavities is obliterated. A histologic study of the cellular elements (cytodiagnosis) is important. The normal cerebrospinal fluid contains not over one or two leukocytes in the microscopic field. Lymphocytosis indicates meningeal irritation, but not necessarily meningitis. It is frequently observed in tabes, paresis, syphilis, tuberculous meningitis, and multiple sclerosis. Cytodiagnosis is of special value in the diagnosis of incipient cases of tabes and general paralysis of the insane. In tuberculous meningitis lymphocytes, and in rare instances polynuclear leukocytes, predominate. The latter occur in advanced stages of the disease. Chemical examination of the fluid shows that in meningeal inflammations the albumin may be increased; in fact, Daskiewitz-Korybut contends that more than 1 per cent. of albumin indicates an inflammatory process and contraindicates the presence of a tumor.

It is claimed by the French clinicians that an early diagnosis of general paralysis may be made by precipitating the serum-globulin with magnesium sulphate, and then by gently warming the cerebrospinal fluid one obtains a precipitate of serum-albumin. In the cyto-count more recent observers no longer centrifugalize the spinal fluid, because the cells become altered and the results are not uniform. The custom is now to use the pipet of the blood-counter and counting in a specially constructed chamber. In the norm there are only 1 to 4 cells per cubic millimeter, whereas in paresis from 12 to 200 or more are found.

Normally the cerebrospinal fluid contains a substance which reduces Fehling's but does not rotate polarized light. This substance is not present in cases of tuberculous meningitis. In the condition known as *meningismus*, which occurs in association with suppurative diseases of the middle ear in children and adults, symptoms are present which simulate meningitis or brain-abscess, although no intracranial inflammation exists. The trouble is essentially functional, occurring in hysterical and neurasthenic subjects.

Jackson,[142] referring to the diagnosis of this affection, directs attention to the absence of the *tache cérébrale*, and the fact that morphin in comparatively small doses is quieting on the erethismic phenomena, whereas much larger doses are required in meningitis. The most positive diagnostic point is recovery of the patient who has shown meningitic symptoms. In such cases (meningismus) the cerebrospinal fluid is normal.

Lumbar puncture may be of value in a diagnostic-therapeutic direction. Thus, the pains secondary to zona (herpes zoster) have been relieved by the withdrawal of 20 cm. of fluid. Here hypertension of the fluid was assumed to exist. Similarly the headaches of chlorosis, plumbism, syphilis, and Bright's disease have been favorably influenced. In affections of the labyrinth dependent on increased pressure of fluid in the internal ear, favorable reports have been published respecting relief of tinnitus, vertigo, and hearing power.

Tuberculous Abscesses.—Such abscesses are particularly observed in children in association with tuberculous diseases of the lymph-glands, bones, joints, etc. Puncture shows a material that resembles pus, but which is not true pus. Caseous matter is found which Gross compared to bits of soft-boiled rice. The fluid contains no pyogenic bacteria, and when allowed to stand, a curdy mass settles below, above which is a thin serous fluid.

Percussion of the Skull.—In connection with lumbar puncture this procedure is worthy of consideration. MacEwen first directed attention to percussion of the skull as a means of determining the condition of its contents. In the presence of an abscess or tumor there will be local increased dullness. In simple fracture of the skull a "cracked-pot" sound has been described. Keen has pointed out the value of percussion in the so-called abscess of the frontal sinus and the antrum. Koplik[143] observes that percussion of the skull is valuable in detecting acute hydrocephalus, caused either by acute distention of the ventricles on the first day of a cerebrospinal meningitis or during the insidious onset of tuberculous meningitis. In distention of the lateral ventricles with fluid the percussion note at a given point varies according to the position of the head. With the head upright, the most resonant note is elicited toward the basal level of the frontal bone and the squamous portion of the parietal. The percussion on the lower bone as the head is inclined to one side gives a tympanitic note. This sign was found by MacEwen in over forty children and young adolescents, who had distended ventricles due to various causes. Koplik's study of thirty-four cases of tuberculous meningitis demonstrates that the MacEwen method of percussion at the pterion is a most valuable sign. (The pterion is located two fingerbreadths (37 mm.) vertically above the middle of the zygomatic arch.) The sign is never present in the norm after the age of two and two and a half years, when the skull is completely ossified and there is normal conformity of the head and there has been no pre-existing hydrocephalus. Koplik considers percussion of the skull as the only definite means of determining whether there is an increase of fluid in the ventricles or the subarachnoid space, causing pressure-effects, and therefore demanding immediate relief. Percussion is executed by means of the finger, as in chest-percussion. Auscultatory percussion may likewise be practised; the stethoscope being fixed to the forehead, percussion at corresponding points on both sides of the head is executed (*vide* tuning-fork).

Spleen.—In chronic malaria the peripheral blood may show no plasmodia, but they may be demonstrated from the blood obtained by splenic puncture. Osler refers to a fatal hemorrhage following exploratory puncture of an enlarged malarial spleen. By means of the vertebral reflexes (page 675) one can induce contraction of the spleen by vibratory concussion of the first, second, and third lumbar vertebræ. Such concussion is important in malaria in a diagnostic and therapeutic direction: (1) The plasmodia are driven into the peripheral blood and may there be demonstrated. (2) Driven into the general circulation the specific action of quinin on the plasmodia becomes more pronounced.

Liver.—The pus from an abscess of the liver is reddish-brown in color, thick, and may contain blood. Microscopically, it consists of necrotic hepatic tissue (liver-cells, elastic tissue, blood, pus-cells, and perhaps amebæ). In about 60 per cent. of the cases the pus of a recently opened abscess contains no bacteria. Amebæ may only be demonstrated in a tropical abscess after several days or by rubbing a piece of gauze on the abscess-wall. Sir Patrick Manson recommends that at least six punctures should be made before the endeavor to discover pus is abandoned.

Lungs.—Puncture of the lung has been considered under visceral puncture. In diagnosis puncture is often necessary as a preliminary measure in operative interference to determine the position and size of cavities (tuberculosis, abscess, and bronchiectasis). Puncture is best attempted at a time when the patient has not expectorated, *i. e.*, before rising in the morning, otherwise the cavities will be emptied. The contents of pulmonary cavities are offensive in odor. According to the degree of the needle's penetration and aspirating, one may determine whether the pus is derived from the pleura or from the lung. If the pus is slimy, it is probably from the lung or a bronchiectasis. The pus of abscess and tuberculous cavities is not slimy. A mixture of air and pus speaks in favor of an intrapulmonary cavity. Care must be taken, of course, to exclude pneumothorax and a leak in the syringe. Air may also be derived from a bronchus.

In my experience the aspirating needle is of the greatest value in the diagnosis of a lung abscess. Before using the needle, our primary endeavor is to locate the site of the abscess. If the latter is near the chest-wall, signs of edema may be present. There is usually a circumscribed area of dullness over the abscess, provided the latter does not communicate with a bronchus, in which instance a cracked-pot sound is elicited, provided the abscess is not filled with pus. The auscultatory evidence will likewise vary in accordance with like conditions. An abscess not communicating with a bronchus may elicit bronchial breathing and amphoric breathing; tinkling and gurgling sounds if it communicates with a bronchus. The Röntgen rays may likewise be employed in locating the abscess, although this may not be easy if there is much pleural thickening or lung consolidation. The presumable site of the abscess having been located, and bearing in mind the fact that in 80 per cent. (Tuffier) of the cases it is located in the posterior portion of the lower lobe, a large needle under aseptic precautions is thrust into the lungs. One negative puncture is by no means decisive. In one of my patients I made ten punctures before obtaining pus. I employ a powerful aspirator in conjunction with the needle. Many years ago, in determining the value of parenchymatous aspiration as an aid in diagnosis, I demonstrated conclusively the perfect innocuousness of punctures made into the normal lung by experiments on animals. At no time was there any macroscopic or microscopic evidence of pronounced pulmonary lesions as a result of the punctures.

Striated hemorrhages limited to the course of the needle were demonstrable, but the bleeding was always slight, owing to the inherent contractility of the tissue and the coagulation of the blood. While the text-books teach that a failure to find pus does not exclude the presence of an abscess, no cognizance, to my knowledge, is taken of the withdrawal of an edematous fluid by aspiration as highly suggestive of pus accumulations in the lung. The failure to find pus may be attributed to one of two causes: either the needle is too short to reach the abscess, or the contents of the latter is too thick to enter the needle. To obviate the latter difficulty, I make use of the following expedient, which is equally applicable in searching for pus in other situations. Before puncture is made, a sterile physiologic salt solution is drawn into the barrel of the aspirating syringe. After puncture is made, the contents of the syringe is injected into the tissue; after waiting a minute with the needle still *in situ*, aspiration is made, and the fluid thus obtained is examined under the microscope. As a rule, sufficient pus-corpuscles are generally obtained to enable one to make a diagnosis of lung abscess, for we must remember that in the environment of the pus cavity there is purulent infiltration, and even though the needle has failed to attain the abscess, the purulent infiltration is encountered by the needle. The center is made up of the débris resulting from the battle between the leukocytes and the infectious factors. It is surrounded by a wall made up of the altered normal tissue of the part, plus leukocytes, embryonic tissue, and fibrin. Around the abscess wall there is a zone infiltrated with leukocytes which extends for a varying distance into the normal tissues. Besides leukocytes there are micro-organisms engaged in combat with the former, fibrin, and serum, and it is the serum which usually makes up the edema, a frequent clinical and pathologic-anatomic sign of an abscess (Fig. 84).

As a rule, the number of pus-corpuscles removed by aspiration in lung affections other than abscess is small. In my case-book I have the records of two patients in whom lung aspiration yielded only an edematous fluid, yet operative measures undertaken proved the presence of an abscess. Such fluid is derived from the inflammatory edema in the abscess environment, yet no attention in the literature has been directed to this point. In one of my patients a fluid only slightly tinged with blood was aspirated. This fluid, examined under the microscope, showed the presence of red and white blood-corpuscles in the proportion of one white to five red corpuscles. I concluded that insomuch as the proportion of corpuscles in the blood was 1 white to 200 red corpuscles, the excess of white was dependent on pus infiltration. In my conclusion I was not unmindful of the fact that in a hyperemia the fluid withdrawn would also contain an excess of leukocytes, yet there would also be present an excess of red corpuscles. It is the latter fact which demands emphasis in the differential diagnosis, viz., a fluid rich in leukocytes without a proportionate augmentation of erythrocytes is always suggestive of pus infiltration.

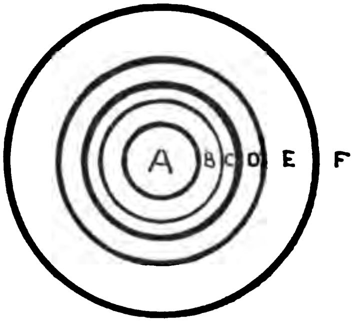

Fig. 84.—Diagram of an abscess (Da Costa): *A*, pus; *B*, layer of fibroblasts; *C*, tissue infiltrated with leukocytes; *D*, zone of stasis; *E*, zone of active hyperemia; *F*, healthy tissue.

Foul gas removed by the syringe is as diagnostic of lung abscess as is pus. Puncturing the pathologic lung is by no means devoid of danger. A blood-vessel accompanies each bronchus and a puncture of the vessel may cause fatal hemorrhage (Fraentzel). Hemoptysis may follow lung-puncture, but it is rarely dangerous. Pleural infection may follow the puncture, the pus escaping along the puncture to the pleura. Gangrene and pneumothorax may also follow puncture. These accidents are in a slight measure obviated, provided pleural adhesions are present, and in a large measure if the operation is at once performed at the time of finding the pus.

In gangrene of the lung exploratory puncture is a dangerous procedure, and should be resorted to only at the time of the operation to facilitate localization of the gangrenous area. The healthy pleura becomes infected in more than half the punctures thus made, and gangrene may follow the line of puncture. The puncture, if positive, yields a foul-smelling fluid or a very offensive gas. Sole reliance must, however, not be placed on puncture, insomuch as the statistics of Tuffier show that it was only positive in two-thirds of his cases. It would appear, however, that the interpretation of the physical signs, and not the puncture, was at fault.

Pericardium.—In rheumatism the exudation is usually sero-fibrinous; it is purulent in septic and tuberculous cases and hemorrhagic in many tuberculous, senile, and renal cases.

Pleura.—Acute pleurisy, according to Osler, may be divided bacteriologically into three groups: (1) A form caused by the tubercle bacillus. This form is present in the majority of idiopathic cases. The exudate is sterile when examined in the usual way. Large amounts of the exudates (15 c.c.) must be taken in making cultures or inoculations to prove the presence of the bacillus. (2) Pneumococcus pleurisy is usually secondary to a focus of inflammation in the lung. The exudate is usually purulent and the prognosis favorable. (3) Streptococcus pleurisy is the most serious of all forms, and is caused by either direct or indirect pleural infection. If a patient has been recumbent for a long time, the upper layer of fluid may be clear and the lower layer purulent (Fowler).

A differential diagnosis may be made by means of the aspirating-needle between an *empyema* and a *subphrenic abscess.* The flow of pus in empyema is most marked during expiration, and in abscess during inspiration, and the same is observed when gas escapes. The needle does not oscillate in empyema, whereas in abscess it does.

The method known as inoscopy is generally employed for detecting tubercle bacilli in pleural exudates. Zebrowski[232] advocates a method directly opposed to inoscopy. His procedure retards coagulation by collecting the chest-fluid directly in a phthorium sodium solution. The sediment formed on standing is centrifuged and the resulting deposit is employed for the smears. About

100 c.c. of fluid are required, and in an examination of thirty-six exudates, bacilli were found in twenty-two of the number.

Autosero-prognosis.—Landolfi[272] refers to the great value of Gilbert's method of autosero-diagnosis, which consists in re-injecting, subcutaneously, serum or effusion taken from the patient's own pleura or peritoneum. A febrile reaction follows when there is tuberculous infection, but not if no tuberculosis is present. Landolfi has been studying the reaction obtained, and he states that it is able to afford important information, not only as to the tuberculous nature of the lesion, but also as to its seriousness and the ultimate outcome. For these points the particulars of the reaction must be recorded for several days after the injection, the curve then showing details which differentiate the affection and announce the outlook. The prognosis is graver the less the amount of effusion required to obtain the febrile reaction. The less the reaction and the tardier its appearance, the milder the affection. In the days following the primary febrile reaction the temperature may surpass that first obtained, or it may equal or not approach it, the severity of the affection being announced by the prolonged reaction. In case of a negative response, the amount of effusion to be reinjected can be increased from 1 to 2, 3, or 10 c.c. If there is no response after the large amount has been injected, and if the temperature remains unchanged or varies very slightly during the days following the injections, the prognosis may be regarded as extremely favorable.

Bladder.—The most suitable site for bladder-puncture is one inch above the upper margin of the symphysis pubis in the middle line. The dangers associated with suprapubic puncture are: peritonitis when the peritoneum is punctured, leaking of the wound, and prevesical abscess. The peritoneum will not be injured if the bladder is distended and puncture is made at the site of absolute dullness on percussion. A small needle prevents leakage and an abscess is prevented by taking aseptic precautions and the employment of urinary antiseptics.

In suspected **disease of the antrum** puncture is made with a small trocar and cannula through the inferior meatus under the inferior turbinate, close against the outer wall of the meatus through the thin antro-meatal septum. Cocain and adrenalin are previously used at the site of puncture. Even a single puncture is diagnostic and curative. If a tooth is the cause of antral disease, it is removed and the antrum perforated through the socket of the tooth.

A **localized edema** may be recognized by needle-puncture permitting the escape of serous fluid. Such edemata not responding to the administration of diuretics, but yielding to a cardiotonic like digitalis, suggest cardiac insufficiency as the etiologic factor.

In **appendicitis** the exploratory puncture, to quote Roux, is not always without danger, often without result, and always superfluous.

Scrotum.—Puncture determines the character of the fluid. A straw-colored or greenish viscid fluid rich in albumin (6 per cent.) is probably from a vaginal hydrocele; a colorless watery fluid with a trace of albumin is usually derived from a hydrocele (testicle, cord, or epididymis); a milky fluid containing spermatozoa, from a seminal cyst; a mucoid fluid which produces a precipitate (mucin) upon the addition of acetic acid, from a cystic testicle; bright-red blood, from a solid testicular growth; altered thick blood, from a hematocele; dark amber-colored fluid, hydrocele of a hernial sac; a colorless fluid containing no albumin and showing hooklets under the microscope (Fig. 82), from an echinococcus cyst. If a sufficient quantity of fluid is removed, the reduced bulk of the scrotum resulting shows that the fluid has been removed from a large cavity and not from cysts. In many instances it is not until the fluid has been removed that the testicle can be properly palpated to ascertain the pathologic condition.

A scrotal swelling in children may be translucent, and yet it may be an **inguinal hernia** owing to the thinness of the intestinal wall and a small amount of fat.

RADIO-DIAGNOSIS.*

Apparatus.—The following are necessary in an *x*-ray equipment for radio-diagnosis: (1) Crookes tube; (2) apparatus for exciting the latter; (3) fluorescent screen. Auxiliary apparatus consists of a tube-holder, examining table, localizers, photographic plates, etc. The tube may be excited by: (1) Static machine; (2) Ruhmkorff coil; (3) some form of high-tension transformer. The static machine is not as powerful as a coil and is uncertain in some districts, owing to its susceptibility to atmospheric changes. A good coil is reliable, shortens the time of exposure, and is portable. The high-tension transformer is a good apparatus when the alternating mains only are available.

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* Consult page 179 *et seq.* on the subject of *x*-rays in the etiology of disease and prophylaxis.

The Crookes tube is a very important part of an outfit. It consists of an exhausted glass bulb containing electrodes: the cathode, or negative pole (concave disk of aluminum), and the anode, or positive pole (flat disk of platinum), which is directly opposite the latter at an angle of 45 degrees. Soft tubes with a low vacuum do not penetrate as deeply as the hard tubes of high vacuum. It is better to purchase tubes which admit of vacuum regulation. Tubes provided with the osmo regulator are very satisfactory. For limiting the extent and direction of the rays and employing only the focal rays the diaphragm of Beck and the compression diaphragm of Albers-Schoenberg are employed.

Radio-diagnosis may be achieved by *fluoroscopy* and *skiagraphy*. In the former method the structures traversed by the rays are directly examined by aid of the fluorescent screen. With a large screen covered with a sheet of gelatin, the organs may be outlined on the latter by means of a soft pencil, such as is used in writing on glass. The tracings may be removed by aid of alcohol. Fluoroscopes may now be purchased with a glass covering which protects the operator from the rays, and upon which tracings may be made; special pencils for writing on glass may be purchased. Fluoroscopy is of special value for observing the movements of the heart, lungs, and diaphragm, the motion of fluids, etc. It is a rapid method, available in children, but does not give the permanent record nor the details of skiagraphy. Skiagraphy demands great skill and much time. It is the only accurate method available in locating foreign bodies and demonstrating calculi.

Skiagrams of the chest give better results when the patients hold their breath during the exposure. To facilitate holding the breath the patient should inhale oxygen before the exposure. Leonard Hill has shown that a man can hold his breath for three times the normal period by taking three inhalations of oxygen, and in one instance the breath was held for eight and one-half minutes.

Examination.—All clothing must be removed from the part subject to examination. The observer should remain in the dark for at least ten minutes before making an examination, so as to increase retinal sensibility to the light of the screen. The best position for the examination is with the patient standing. Some device should be employed for moving the tube. Many supports are used for this purpose so that the focus tube is freely movable in all directions and provided with a diaphragm, the aperture of which can be altered for limiting the illuminated surface. The possession of an *x*-ray apparatus does no more in postulating a knowledge of skiascopy than the possession of a microscope of microscopy. The errors perpetrated by the microscopist are no less grave than those of the skiascopist. The rays have not supplanted the conventional physical signs of thoracic disease; on the contrary, the latter signs have advanced in value since the advent of the former. The proper interpretation of an *x*-ray examination coupled with correct technic means essentially a study of chiaroscuro, or of light and shadow effects. An *x*-ray examination is practically an autopsy conducted during life, with the advantage that the functional activity of the organs accelerates diagnosis, on the principle that a clinical is often more easy of achievement than an anatomic diagnosis.

Normal Chest.—The positions of the tube are: (1) Anterior, (2) posterior, (3) right anterior oblique, (4) left posterior oblique, (5) lateral. In the anterior and posterior positions the screen is applied directly to the anterior and posterior surfaces of the thorax, the tube in each instance being on the opposite side of the screen.

In viewing the chest either from in front or behind, one notes a central shadow, cast by the mediastinal contents (heart and vessels), sternum, and vertebral column, and two lateral transparent zones.

Above, to the left of the shadow cast by the spine: shadow of the aorta.

Below, to the left of the shadow cast by the spine: shadow of the left ventricle.

Between the latter: Shadows of the left auricle and pulmonary artery.

Above, to the right of the shadow cast by the spine: shadow of the vena cava superior.

Below, to the right of the shadow cast by the spine: shadow of the right auricle.

The commencement of the descending aorta is marked by a distinct prominence, which is more pronounced when the screen approximates the posterior surface of the chest. The lateral zones are transparent and correspond to the lungs. The transparency is obscured at certain points by shadows of the ribs, clavicles, and diaphragm. The scapulæ, mammæ, and dense muscles may also cast shadows in the normal subject. The cardiophrenic space is a triangular space between the heart and diaphragm which augments in area during deep inspiration and separates the shadows of the heart and diaphragm.

In noting the excursions of the diaphragm observe that the diaphragm does not become flatter with each inspiration, but that its curve is always maintained. Any variation in the amplitude of the diaphragmatic movements on both sides is abnormal.

The lateral position is employed in estimating the anteroposterior diameter of the heart; the screen on one side and the tube on the other side of the patient. In front of the shadow cast by the heart is the retrosternal space, and behind, the retrocardiac space. Both spaces increase in area during forced inspiration.

Lungs.—The normal lungs offer no resistance to the rays. They are brighter during inspiration than expiration. Brightness of the lungs is a relative term, and is dependent on the density of the thoracic coverings and the degree of lung inflation. Shadows are cast normally and the most important situation is the apical regions. Here the muscles may cast a shadow, but raising and lowering the arms, by increasing or diminishing the area and intensity of the shadow, refers the origin of the umbra to the shoulder muscles. The scapulæ also cast shadows, but they are likewise identified by movements of the arms. A lung not distended to its physiologic capacity offers an obstacle to the transmission of the rays, and consequently the appearance on the screen of shadows. I have referred elsewhere to the atelectatic zones (page 488). Unless the latter are eliminated, mistakes are bound to occur, and will prove as egregious as those committed by Holmes' young physician, whose stethoscope lodged the spider and the couple of imprudent flies. Before an *x*-ray examination, every effort must be made to eliminate unemployed lung areas by repeated forced inspirations. On either side at the root of the lung an arboreal shadow may be seen, especially at the height of inspiration. This shadow is caused either by the subdivisions of the bronchi or the branches of the pulmonary artery or both.

The majority of lung affections, if demonstrable by the rays, throw shadows on the screen. The trained eye may, by the density of the shadows cast and their situation, determine, to a limited degree only, the nature of the anatomic condition. Thus, the presence of fluid in the pleura or a tuberculous lung casts more pronounced shadows than a thickened pleura, a lung abscess, or a bronchopneumonic patch. A lung shadow gives one the impression of density and is circumscribed, whereas a thickened pleura yields a less dense and more diffuse shadow. Shadows limited to the center of the lung cannot be pleurogenic, and this shadow localization is not only of great importance in diagnosis, but furnishes an index to the site of an operation in lung surgery; whether the object to be attained be the drainage of a bronchiectatic cavity, opening of an abscess, or the location of a foreign body. The nearer the lesion which casts the shadow is to the screen, the less exaggerated and more clearly defined will be the shadow. The shadow cast in respiration will not differ materially in position nor in clearness of outline if the lesion is situated near the screen; if, however, it is distant from the screen, the shadows will be greater in extent and their contours will be indistinct. In making a focal diagnosis, the patient must be examined with the light in front and behind him.

Pulmonary Tuberculosis.—A tuberculous infiltration casts a shadow, but one must not forget that the presence of a shadow is not an early sign of the disease, but one that is equally as tardy as the recognition of tubercle bacilli in the sputa. Some claim that no shadow is cast until caseation has occurred, and only a few claim that even the gray tubercles cast a shadow.

There are two early signs, viz., restriction of the excursions of the diaphragm and the emphysematous *x*-ray appearance of the lungs. The physiologic diaphragmatic excursions vary according to whether the breathing is quiet or forced. In quiet breathing the extent of movement is about 1.8 cm. on the right, and 1.5 cm. on the left side; whereas, in forced breathing, the difference in the position of the diaphragm between forced inspiration and expiration averages 6.7 cm. on the right and 7 cm. on the left side. Any variations from these normal figures must be regarded as suspicious of phthisis, other things being equal. Individuals with long thoraces show greater excursions of the midriff than deep-chested persons. The limited diaphragmatic excursion as a sign of early phthisis was first referred to by Williams, but no theory has been advanced to explain its existence. The cause I believe to be resident in the emphysematous condition of the lungs in early phthisis (page 495).

Some writers refer to a radio-diagnostic sign of early phthisis, viz., that one or both apices fail to light up during inspiration. My observations teach me the contrary, viz., the lungs appear permanently bright, not alternately so with inspiration as in the norm, and the condition in phthisis may be described as the "statuesque lung." Unlike in health, forced expiration causes no cloudiness in the lung apices. In the majority of phthisical cases the heart is smaller than normal. In the later stages of the disease the heart is larger than normal, due no doubt to the increased resistance in the pulmonary circulation.

In searching for lung shadows the light must often be so adjusted by means of a lead diaphragm as to barely illuminate the lung. Comparisons should always be made between the two sides. This necessitates the employment of large fluoroscopes in lieu of the diminutive screens that parade as such. If the shadow is caused by lung collapse, elicitation of the *lung reflex* will cause the lung to dilate and cause an immediate evanescence of the shadow. If cavities exist, they show as light areas unless filled with pus or secretions, when dark areas are seen. When the secretions are expectorated, the dark areas become light.

Bronchial Phthisis.—By this term is usually understood a tuberculous lymphadenitis of the tracheobronchial glands. The writer[146] has described an unconventional picture of bronchial phthisis occurring in adults, which in all essentials tallies with the tableau of symptoms common to pulmonary tuberculosis, with which it is frequently confounded. He has collected a number of cases in which the tracheobronchial glands were alone involved, without pulmonary implication. The Röntgen ray evidence of enlarged glands without lung involvement is highly characteristic: (1) There are the negative results obtained from lung skiascopy. (2) There is evidence of enlarged glands. The latter evidence is more easily elicited by fluoroscopy of the posterior thorax. The best results are obtained, in determining enlargement of the glands, if the target of the tube is so placed that the rays traversing the chest will fall at a point corresponding to either the right or left side of the sternum anteriorly, or to similar points posteriorly, in the region corresponding to a point just below the tracheal bifurcation. The shadows thus obtained look not unlike those obtained in aortic aneurism.

Pneumonia.—Consolidation casts a distinct shadow. In central pneumonia, where physical signs are useless, a shadow may also be obtained. The diaphragm movements are restricted on the affected side. The recognition of the condition of the lungs after apparent recovery from pneumonia is one of the most important but neglected problems of the physician. The sequelæ of unresolved pneumonia are many. I have learned one lesson of which I am proud, and that is to observe and treat the lungs after apparent recovery from an attack of pneumonia by lung gymnastics. Cases of apparently protracted bronchitis in children and adults are often in reality cases of bronchopneumonia, the discrete patches of which disease are made evident by the shadows thrown on the screen. The rays are also valuable in senile pneumonias when there is no pyrexia and indefinite physical signs.

Emphysema.—The lungs are brighter and more voluminous than in the norm. The ribs are brighter and have lost their normal angle, now being more horizontal in direction. The lungs do not alternately become cloudy during expiration and brighter during inspiration. The diaphragm is low and restricted in its movements. The shadow of the heart stands out clearly and there may be dilatation of the right ventricle. This organ is lower and its axis more vertical. Any areas of consolidation incapable of detection by physical signs are readily seen.

Asthma.—Many writers regard the rays as specific in action in asthma of bronchial origin, *i. e.*, when the attacks are associated with bronchitis. The rays are without action in asthma due to cardiac or nervous factors, hence the psychic action of the rays can be excluded. Even the asthmatic attacks may be aborted and the results are said to be almost immediate. It is usual to expose all sides of the chest (front, back, and sides), and the total exposure at each sitting should not exceed ten minutes.

Pleural Effusions.—The diaphragm is in slight evidence or not seen at all. The dark area represented by the fluid casts, as a rule, a more distinct shadow than is observed in most affections of the thorax, and the shadow may change on the patient's position being altered. The dense shadow of a pleural effusion possesses the hydrostatic properties of seeking its own level. Dislocation of the heart may be seen when it exists. When due to fluid, cardiac dislocation is toward the opposite side of the chest on which fluid exists, whereas in pulmonary disease the dislocation is toward the affected side. Between the outer end of the diaphragm and the thoracic wall a clear triangular space exists which is only occupied by lung during deep inspiration. This space is still seen even in extensive consolidation of the base of the lung, but it is at once obliterated even in the presence of small quantities of fluid. Hence, if this space can be seen, no free fluid is present on that side of the chest.

Pleural thickening, which may be confounded with small effusions, may be differentiated by a careful study of the space just mentioned. There is no cardiac dislocation and there is no increase in the breadth of the chest on the involved side. In encysted pleurisies there is a stationary dark shadow. Unsuspected complications of pleurisy, such as tuberculosis and pneumonia, may be determined when the conventional physical signs lead us into error. If pleural adhesions are present, their presence may be indicated by limited excursions of the diaphragm. In deciding whether effusions are above or below the diaphragm, one may occasionally note that in effusions below the latter, the upper border of the shadow is limited by the shadow of the diaphragm. In doubtful cases the following method of Achard may be tried: After an exploratory puncture and the withdrawal of a certain quantity of fluid, a certain amount of sterilized air is injected through the needle. An *x*-ray examination will show that if the fluid is below the diaphragm, the clear area produced by the injected air is separated from the lungs by the shadow of the diaphragm. If the fluid is above the midriff, this change is not noted, and the behavior of the fluid plus air is like that in pyopneumothorax—the fluid being freely movable within the thoracic cavity.

Pneumothorax.—The affected side of the thorax is unusually clear. The diaphragm is low and its movements restricted. The heart is dislocated toward the opposite side.

In pyopneumothorax and hydropneumothorax the upper border of the shadow is defined and maintains its horizontal posisition notwithstanding shifting of the patient at different angles. With the patient in the recumbent posture, however, then the affected side in its entirety becomes dark. Rhythmic wavy movements corresponding to the heart's action may be seen, especially when the affection is left-sided. When the patient is shaken, splashing on the surface of the fluid can be demonstrated. The picture is likened to a tumbler half filled with ink and is very conspicuous. One may define the area described by an old empyema by the injection of iodoform-glycerin or bismuth. The latter defines more clearly than the former, but it may be objectionable, as it disturbs the healing of the wound.

Pulmonary Tumors.—Neoplasms of the lung are indicated by shadows. They may be detected in the absence of physical signs. Tumors of the thoracic wall may be defined and implication of the lung or pleura may be demonstrated. In such instances the retrosternal and retrocardiac spaces should be carefully examined.

If the shadow of a lung neoplasm is extensive, it may present the appearance of a pleural effusion, but, unlike the latter, the density does not increase from below upward.

Heart.—The heart is better defined during forced inspiration, at which phase of respiration it is dislocated downward and inward, its transverse diameter is diminished, and the amplitude of its pulsations is diminished. During expiration the long axis of the organ assumes a more horizontal position. Examined in the lateral position, the retrosternal space widens and lengthens on deep inspiration and the heart is dislocated downward and the upper part backward. Radio-diagnosis is more accurate than percussion in defining the dimensions of the organ, provided advantage is taken of orthodiascopy. The dimensions of the heart are noted in the skiascopic table. *Orthodiascopy* is em-

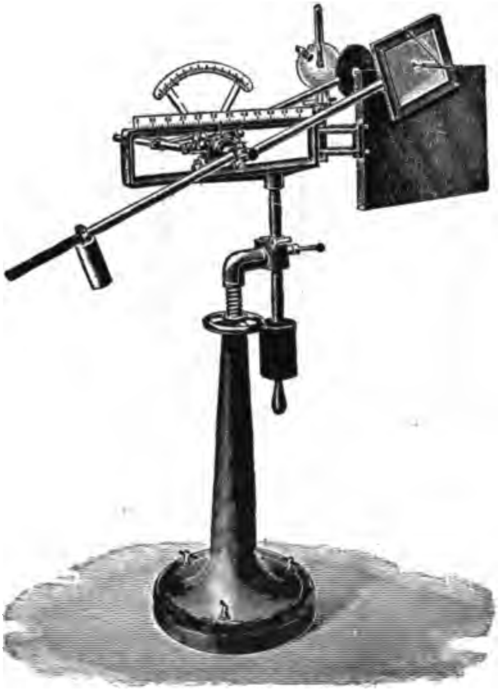

Fig. 85.—The orthodiagraph.

ployed when accurate measurements of the dimensions of the heart are demanded. When light casts a shadow of an object on a plane surface, there is a parallel and a central projection and the image is larger than the object (Fig. 86).

Among the rays projected by the tube there is one (*D H*) which approaches the screen in a perpendicular direction (ray of normal incidence). In orthodiascopy the perpendicular ray is conducted around the circumference of the organ. Several methods have been suggested to accomplish this object, and the apparatus generally employed is the orthodiagraph (Fig. 85). This instrument

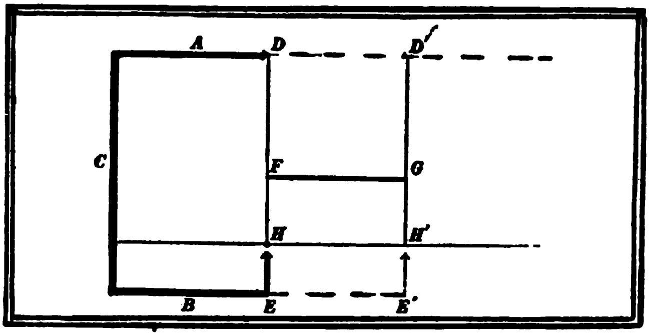

Fig. 86.—The principle governing the orthodiagraph. *A* is the bar supporting focus tube; *B* is the bar supporting the pencil; *C*, the bar connecting *A* and *B*; *D*, the anticathode; *E*, the pencil fixed opposite *D*; *F G*, the object to be measured. The ray of "normal incidence," *D H*, touches the left border of *F G*, and projects this spot on *H*, which is then marked with pencil *E*. *D* is now moved to *D'*, so that the normal ray *D'H'* touches the right border of *F G* at *G*, and projects this spot on *H'*, which is marked by the pencil *E'*. The image *HH'* is equal to *F G*. The line on which *H* and *H'* are marked by *E* represents, of course, the glass or paper on which the tracing is being made (Walsham and Orton).

can be used either in the vertical or horizontal position. It is made up of articulated levers, and the tube follows the movements of the pencil, which is fixed opposite the anticathode. The rays furnish information respecting the size, form, position, movements, and relation of the heart to the other organs. Here I wish to make brief reference to skiascopy, which is a pathognomonic sign of *cardioptosis*. The long axis of the heart appears to be practically parallel with the surface of the diaphragm; the boundaries are poorly defined and deep inspiration does not bring into evidence the cardio-phrenic space. This posture of the heart could be assumed if the midriff were abnormally high, as in abdominal distention, yet if the long axis of the heart were measured, it would be found by describing the distance of the axis on the chest-wall, that it would extend higher in the thorax than would a normal heart. The highest anatomic point of the heart is represented by the left auricle, which is at the lower border of the sternal insertion of the second rib; its lowest point is at the upper border of the sixth costal cartilage or in the fifth intercostal space within the mammary line. Measurement of the long axis of the heart in cardioptosis would show that the heart lies lower than normal. In cardioptosis there is little or no respiratory or attitudinal dislocation. My measurements of the normal *attitudinal dislocation* show that in the left lateral posture the heart moves on an average of 2.6 cm. to the left and 1.1 cm. upward; in the right lateral posture, 1.5 cm. to the right and 0.5 cm. upward. As a rule, such dislocation is less evident in children than in adults, and less marked in obese individuals than in lean ones. Cardioptosis is more common than is ordinarily believed. The subjects may complain of weight or oppression in the lower chest with dyspnea on exertion. This subject has been more fully discussed elsewhere.[147]

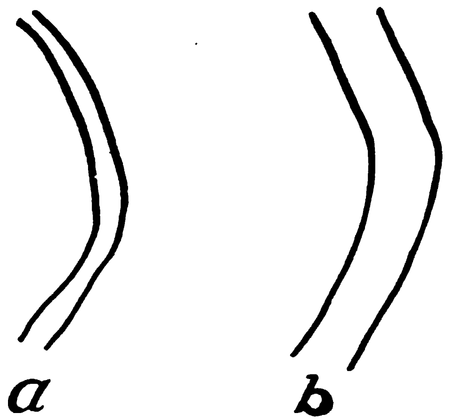

Fig. 87.—Heart reflex of a patient with myocarditis; *a*, reflex before, and *b* after, taking digitalis. The augmented amplitude of reflex in *b* indicates an improved condition of the myocardium.

Heart Reflex.—With the fluoroscope in position, one can easily elicit this reflex (page 375) by scratching the skin of the precordia several times with the blunt end of a pencil. The reflex is valuable as an index to the condition of the myocardium, and when the cardiac muscle is beyond restitution in myocarditis and valvular disease the reflex cannot be elicited. In differentiating heart from other structures—for instance, an aneurism—it is also of value. In the differentiation of a pericardial effusion from a dilatation of the heart, the reflex is absent in the former condition. Pericardial synechiæ also preclude the occurrence of the reflex. The reflex may also be used as a guide to cardiotonic medication. Reference to Fig. 87 will illustrate my meaning. The reflex is also of value in the diagnosis of relative insufficiency (page 772).

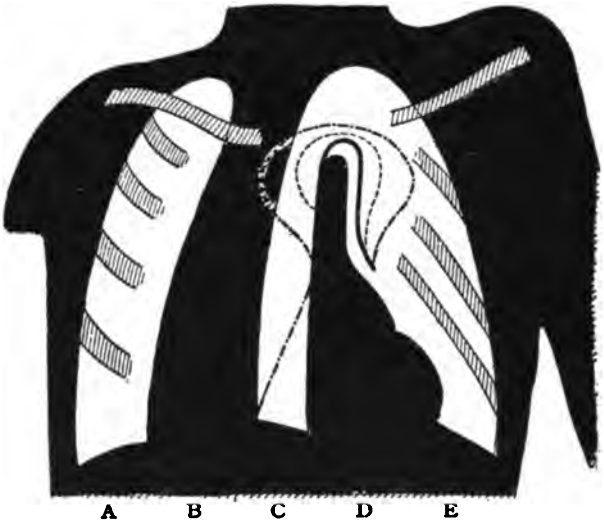

Fig. 88.—Right anterior oblique position. *A*, clear area, corresponding to right lung; *B*, shadow of vertebral column; *C*, clear middle space; *D*, shadow of normal heart and aorta; *E*, clear area corresponding to left lung. ━━━, dilated aorta; ......, small commencing aneurysm; —-——-, upper part, larger aneurysm; —·—·—, lower part, position of dilated auricle.

Pericardial Effusion.—In this condition the cardiac shadow is augmented, the outlines are rounded and irregularly pear-shaped. The pulsations are either diminished or absent. Even in small effusions the cardio-phrenic space is obliterated, and the same applies to the retrocardiac space. Fluctuation in shape and in position of the shadow is observed when the position of the patient is changed. The heart reflex cannot be elicited.

Thoracic Aneurism.—In the early history of radio-diagnosis thoracic aneurisms were diagnosed more frequently than in the present state of our advanced knowledge. Thus, Sailer and Pfahler have demonstrated that tortuosity of the aorta in arteriosclerosis strongly suggests aneurism on fluoroscopic examination. Many errors are now obviated by an *x*-ray examination in the right anterior oblique position (Holzknecht); the rays are made to penetrate the chest obliquely at an angle of 45 degrees from behind forward and from left to right; the screen is in front and to the right and the tube behind and to the left. In this position the aortic shadow with parallel sides is observed throughout its entire length, and terminates in a rounded extremity at a point corresponding to the level of the strenoclavicular articulations and the third dorsal vertebra. The picture presented in this position is illustrated (Fig. 88) after Holzknecht.

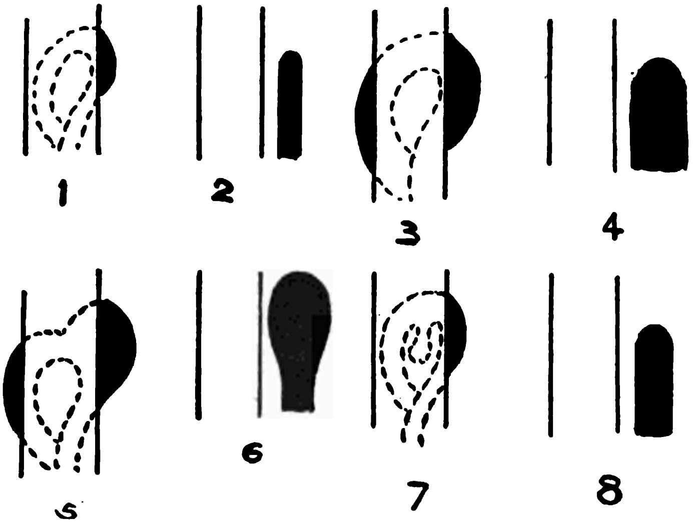

Fig. 89.—Radioscopic examination of the aorta, after Holzknecht (*vide* description in the text).

Reference must also be made to the accompanying illustration (Fig. 89). No. 1 illustrates the normal aorta in the antero-posterior examination; the parallel lines show the central opacity, and the part shaded, the aorta, which extends to one side of the central opacity. In No. 2 an examination of the normal aorta conducted in the right anterior oblique position, shows the vertebral shadow, represented by the parallel lines, and the shaded part, the aorta. No. 3 is the aorta examined in the ordinary antero-posterior position, and the supposition would be that an aneurismal sac is present, but if the patient assumes the right anterior oblique position, the sac is no longer evident (No. 4), but the aortic shadow is broader and retains its parallel borders, hence aortic dilatation and not aneurism exists. Nos. 5 and 6 illustrate an aneurism, and 7 and 8 a small aneurism arising from the under surface of the arch. Note that in Nos. 7 and 8 there is nothing in the pictures to indicate that an aneurism exists; in fact, the appearance differs in no wise from the normal (Nos. 1 and 2). In all examinations for a suspected aneurism the tube should be placed in all positions.

The shadow of an aneurism is more pronounced, the greater the amount of organized clot. If the shadow is situated to the right of the central opacity and nearer the front than the back of the chest, the ascending aorta is involved; but if the shadow is projected to the left and nearer the back than the front, the descending aorta is probably involved. The depth of the aneurismal sac from the surface may be approximately determined on the principle that the nearer the sac is to the surface, the more defined will be the outlines and the less intensified the shadow. Hence, in rotating the patient and examining the shadow anteriorly and posteriorly, it is presumably nearer that surface where the shadow is the smaller and more clearly defined. The course of the aneurism during treatment may be followed if at the primary examination a record is made by means of the orthodiagraph. Pulsations of a shadow argue for an aneurism, but the latter does not always show pulsation; in fact, a dilated aorta may show more forcible pulsations than an aneurism. When pulsations are absent, the inhalation of amyl nitrite, as I have frequently demonstrated, will bring them into existence. Neoplasms may show a communicated pulsation from the heart or the blood-vessels. The heart is generally admittted by authors to be displaced downward as a whole. My own observations show that, if for any reason there is any encroachment on the respiratory area in the upper thorax (as in aneurism), the midriff becomes fixed in the position of deep inspiration, and with this descent there is a downward luxation of the heart, which I have called the dislocation of accommodation. In old age this dislocation is common, and the low position of the diaphragm and heart is a mere accommodation phenomenon to compensate for the increased length of the aorta. If one makes firm compression of the upper thorax in a child, one may note the immediate descent of the heart. Cardiac dislocation in thoracic aneurism is usually regarded as a result of pressure, but the fact is, it occurs in early aneurism before the heart is capable of mechanic dislocation. In aortitis and aneurism associated with anginous signs, the diaphragm lies high, as if to support the heart and diminish traction on the blood-vessels. It is only a question as to whether pain or dyspnea predominates in diseases of the heart and blood-vessels; if the former, the heart lies high; if the latter, it is low.

The Aortic Reflexes.—To elicit these reflexes one may employ a hammer and pleximeter (Fig. 27), or, in the absence of the latter, the palm of one hand is applied closely and firmly to the spinous processes to be concussed, while the other clenched hand is employed as a plexor, striking the dorsum of the first hand a series of sharp, vigorous blows. To elicit the aortic reflex of dilatation, one concusses, after the manner cited, the spinous processes of the eighth, ninth, tenth, eleventh, and twelfth dorsal vertebræ. Immediately thereafter (for the reflex is of short duration—from one-half to one minute), percuss with a strong blow the region of the thoracic aorta, and the course of that vessel, even in the norm, may be defined. The course of the upper surface of the normal aorta, in the adult of middle life, may be projected on the chest by drawing a curved line, beginning at a point corresponding to the right sternal line in the middle of the first intercostal space, and ending at the point of insertion of the first rib to the sternum. The highest point of the aortic arch is distant about 5 cm. and the beginning 2 cm. from the anterior thoracic wall, hence a forcible percussion blow which is transmitted to a depth of about 5 cm. cannot fail to elicit the dullness of the aortic arch if it is dilated. In the elicitation of the reflex in question, one must be chiefly guided by the sense of percussional resistance. Concussion of the spine of the seventh cervical vertebra after the same manner causes the aortic dullness to evanesce at once, as a result of the counter-reflex of aortic contraction.

That alternate dilatation and contraction of the aorta follow the concussional maneuvers already mentioned may be shown by the Röntgen rays. Many control investigations have demonstrated that the lung (lung reflexes of Abrams) is in no wise implicated in the percussion changes. The Röntgen ray pictures employed for control purposes fail to correspond in degree with the decided changes noted by percussion. The latter fact is in accord with reason, considering that, while percussion produces results varying with the approximation of the aorta to the thoracic wall, with the rays the sagittal diameter of the aorta is not taken into consideration. The same fact is pertinent in determining the relative shadow of an aneurism by the *x*-rays and the area of dullness by percussion. More than two years' experience with the aortic reflexes shows them to be fairly constant, but variable in duration. An accompanying illustration (Fig. 90) shows the areas of a thoracic aneurism in a patient seen in consultation with Dr. J. B. Frankenheimer, of San Francisco. The aortic reflexes were specially pronounced, and this despite the fact that theory would have dictated otherwise, considering the supposititious annihilation of the vessel's elasticity. The black line represents the area of percussional dullness of the aneurism, whereas the interrupted lines within and without the black line represent respectively the reflexes of aortic contraction and dilatation. In Fig. 91 practically the same results are noted in a case seen in consultation with Dr. A. J. Sanderson, of San Francisco. This case was specially interesting for the reason that we could control our concussional results by means of the *x*-rays. Fig. 92 represents such results observing the patient with his back approximating the fluoroscope. The black line represents the shadow outline of the aneurism, whereas the dotted lines within and without this line represent respectively the reflexes of aortic contraction and dilatation. Note that although Figs. 91 and 92 represent the same aneurism, the percussion results in no wise correspond with the skiascopic results, and for the reasons already adduced.

In all, I have examined thus far twenty-nine patients with aneurism of the thoracic aorta, and in only two instances were the aortic reflexes absent, hence the reflexes in question are of undoubted value in eliciting the nature of doubtful intrathoracic shadows in radio-diagnosis and in ordinary percussion. To facilitate the elicitation of dullness on percussion, *vibrosuppression* may be used. For further facts concerning the aortic reflexes, *vide* vibratory massage.*

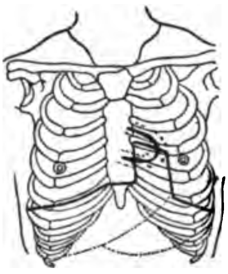

Fig. 90.—Aortic reflex observed in Dr. Frankenheimer's patient.

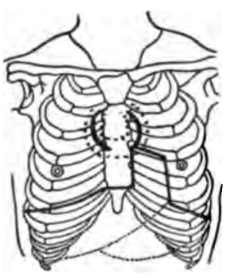

Fig. 91.—Aortic reflex in Dr. Sanderson's patient (anterior view).

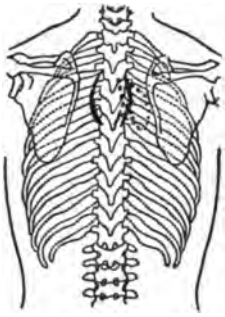

Fig. 92.—Posterior view of Fig. 91. The black lines represent the area of the aneurism as determined by percussion; the interrupted lines within the black lines represent the aortic reflex of contraction, whereas the interrupted lines without the black lines indicate the counter reflex of dilatation of the aorta. Note in Fig. 90, that only one part of the aneurismal wall responds to the reflex of dilatation, a not infrequent phenomenon when aneurisms have attained some magnitude.

The Head.—Here fluoroscopy is rarely of value. Skiagraphy is usually employed, aided by the diaphragm of Beck, to prevent diffusion of the rays and to bring out detail in the skiagram. By skiagraphy, one may differentiate the layers of the skin, skull, and dura mater. The rays are of the greatest value in the examination of thin bones, like those of children. Tumors of the facial bones and their encroachment on the cranial cavity can be determined. Brain-tumors are available in skiagraphy only when they become resistant to the penetration of the rays, as in calcification. In rare instances their presence may be suspected when ulceration of the calvarium is associated with the neoplasm. Tumors of the hypophysis are indirectly diagnosed by changes noted in the sella turcica. Meningocele and other congenital defects, as well as deviations in the auditory meatus, may be demonstrated. Foreign

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* Coughs, pains, and other pressure-symptoms caused by a *thoracic aneurism* are often temporarily subdued by a single application of a vibratory apparatus (percussion stroke) to the seventh cervical vertebra. Conversely, concussion of the four lower dorsal vertebræ will accentuate the symptoms, and this is also true in aortitis.

SKIASCOPIC TABLE OF THORACIC DISEASES.—(*Abrams.*)

Disease.	*x*-Ray Appearance.	Diaphragm.	Heart.	General Remarks.
Abscess of lung...........	Site of abscess indicated by dark shadow, usually found in lower lobe of lung. Shadow may disappear when abscess cavity is emptied.	Excursions usually limited on affected side.	No dislocation of the viscera.	If abscesses are multiple, shadows are small and diffused.
Thoracic aneurism........	If involving descending arch, shadow to left of sternum and above heart; if of the ascending aorta, shadow to right of sternum. Large aneurism may throw a shadow on both sides of sternum. Pulsation visible if sac is not too thick nor filled with clots.	Excursions may or may not be restricted.	Heart usually displaced downward to left. Left ventricle may be enlarged.	Shadow in aneurism of ascending aorta nearer the front chest; if of descending aorta, it is near back of chest. Simple dynamic throbbing of aorta and dislocation of artery by displaced vertebræ must not be confounded with aneurism. In aneurism also search for pulsation and shadow in region of left scapula behind.
Asthma..................	Lungs brighter than normal, extend higher and lower in chest.	Lies low and excursions retarded.	Position of heart lower and moves less during inspiration than normal. Right ventricle enlarged and outlines of heart unusually clear owing to bright lungs.	After a paroxysm, normal brightness of lungs and diaphragmatic excursions reappear unless emphysematous lung changes have become permanent.
Atelectasis (collapse of the lung)..................	Shadows correspond to areas of collapse. If collapse is extensive, shadows are correspondingly so. If occurring as a complication of bronchitis, shadows will appear corresponding to areas implicated.	Excursions restricted, as a rule.	Normal.	Forced breathing will dissipate shadows. Rubbing skin of chest or spraying with ether will cause shadows to disappear (lung reflex).

Bronchiectasis............	No shadow unless lung adjacent to bronchiectasis is solidified; then shadows are usually found in middle and lower thirds of lung posteriorly.	If emphysema complicates affection, excursions are restricted and midriff lies low.	The right ventricle may be enlarged as a complication. The occurrence of fibrosis may dislocate heart.	If chest is examined before a bronchiectatic cavity is emptied by coughing, a distinct shadow corresponding to cavity is evident and is superseded by a bright area when contents are expectorated.
Bronchitis................	Normal lung brightness, but perhaps a shade less bright when free secretion is established. In latter instance diffused cloudiness is usually limited to the lower two-thirds of the lungs.	Excursions normal unless smaller tubes are obstructed; then they are restricted. Coughing, by removing secretions, may restore normal excursions.	Position unchanged. In chronic cases, right ventricle may be dilated.	In the bronchitis of influenza a localized shadow or shadows may be caused by complicated foci of lobular pneumonia. Shadow confined to apex suggests bronchitis of tubercular origin.
Bronchopneumonia........	Circumscribed shadows widely scattered through the lung. Coalescence of foci of inflammation increases area of shadows. Shadows usually limited to middle and lower lobes.	Movements very much restricted and diaphragm may be high, especially during inspiration.	Unchanged, as a rule.	Shadows due in part to areas of lung collapse, in which instance coughing and deep breathing will cause their evanescence, but shadows caused by foci of inflammation persist.
Congestion of the lungs....	Bases of the lungs cast a faint shadow. The rest of the lungs are from temporary overdistention unusually bright.	Midriff lies low and is not as clearly discernible as normal and shows restricted excursions.	Position unchanged, as a rule, although it may lie low. Right side of heart distended.	If congestion be dependent on cardiac incompensation, the use of cardiac tonics will soon dissipate shadow.
Emphysema..............	Pulmonary area of increased brightness which extends higher and lower in the chest.	Low and restricted in movements.	Area clearly defined; lies low. Right ventricle and auricle are enlarged.	If tuberculosis complicates emphysema, abnormal lung brightness is marked by shadows usually confined to apices.
Empyema................	*Vide* pleurisy with effusion. Displacement of the heart and liver is greater in empyema than with the same quantity of serous effusion. In pulsating form of pleurisy (usually in empyema) the heart movements transmitted to fluid may be seen as diffuse undulations if patient is motionless.			

SKIASCOPIC TABLE OF THORACIC DISEASES.—(*Abrams*). (*Continued.*)

DISEASE.	*x*-RAY APPEARANCE.	DIAPHRAGM.	HEART.	GENERAL REMARKS.
Pericardial effusion........	Cardiac area enlarged, but differs from shape of mere cardiac enlargement by being rounded. Pulsations of heart no longer evident.	In sitting posture, position of left diaphragm cannot be followed so far toward median line as in health. Movements restricted.	Cardiac area low.	Best skiascopic view is often obtained from back when lung is not too compressed; then the conical appearance of apex is lost. Triangular space behind heart is obliterated.
Pleurisy with effusion	Diffused shadow on affected side; dark area changes with position of patient. As effusion is absorbed, a lighter area increases from above downward.	On affected side outline less defined or obliterated.	Heart displaced to right or left side, according to side affected. Liver displaced downward in large effusions only.	Any lung visible on affected side is darker than on healthy side, owing to compression by effusion.
Pneumonia (croupous)	Affected lobes cast dark shadows. Middle portion of lung usually affected (between second and fourth ribs).	May be obliterated; excursions very much restricted.	Usually enlarged on right side and displaced toward unaffected side.	Shadow of affected area persists until complete resolution occurs. Persistence of shadow may indicate complications or thickened pleura.
Pneumothorax............	Affected side very bright and area of clearness increased.	Low and shows no movement.	Outlines clearly defined and dislocated toward unaffected side.	The degree of dislocation of heart and liver dependent on intrapleural pressure.
Pneumohydrothorax and pneumopyothorax.......	When patient is in sitting posture there is a very dark area below and a very light one above on the affected side. Level of dark area (fluid) rises with inspiration.	Obliterated and no movements seen.	Heart displaced toward unaffected side.	The degree of dislocation of heart and liver dependent on intrapleural pressure.

Subphrenic abscess (containing air)............	Dark shadow limited to lower thorax, above which is a very light area (air), and above this a slightly dark area caused by compressed lung.	Obliterated and no movements.	Heart displaced toward unaffected side, but not to same degree as in pneumohydrothorax.	Level of dark area changes on change of position of patient, and when patient is shaken by the shoulders splashing of fluid is observed.
Tuberculosis (pulmonary)	Apex of affected side darker than normal and area of same does not increase with inspiration. In acute miliary tuberculosis, lung shows discrete shadows embedded in a light environment (overdistended lung). Cavities, if filled with mucus or fluid, show circumscribed shadows; but when empty, appear as light areas if not surrounded by consolidated lung.	Excursion very much restricted, especially on side affected.	May be dislocated in extensive disease toward unaffected side. In chronic cases, right side enlarged.	Progression or retrogression of lesions may be determined by repeated examinations. An apex not fully inflated may cast a shadow even in the absence of disease. (*Vide* atelectasis.)
Tumors..................	Shadows are cast by intrathoracic growths. They are circumscribed, as a rule, and are commonly confined to the middle or upper part of chest. If they pulsate, pulsation is an up-and-down movement and not expansile, as in aneurisms.	Normal, as a rule, in position and excursions.	Heart may be dislocated by large growths.	Locate site of all lesions as follows: Point x-ray tube in direction of the anterior, posterior, and lateral chest-walls respectively, and on these different aspects mark with pencil the location of shadow. Next determine form of chest with cyrtometer and transfer this form on paper. Connect sites of shadows as perceived on different surfaces of chest by lines, and at the intersection of the latter the lesion will be situated.

Diseases of the Diaphragm.—In spasm, diaphragmatic movements are practically suspended on affected side. Suddenly diaphragm contracts and descends several inches below its normal descent. Singultus may accompany the descent, while cyanosis and dyspnea become intense (per-

SKIASCOPIC TABLE OF THORACIC DISEASES.—(*Abrams.*) (*Continued.*)

sonal observation). In paralysis movements of diaphragm on affected side are suspended; during inspiration, midriff rises. In diaphragmatic pleurisy, movements of diaphragm very much restricted or even suspended. Lungs in upper part of chest brighter than usual, owing to overdistention.

Normal lungs are brighter during inspiration than expiration.

Average normal excursion of diaphragm in quiet breathing: 1.5 cm.; between full inspiration and expiration, 6.7 cm. on the right side and about 7 cm. on the left side. In long-chested persons diaphragm excursions are greater than in short persons with deep chests.

Width of Normal Heart.—(Screen about 75 cm. from tube with target directed toward a point where median line is crossed by fourth rib.) Right heart measures 3 cm. from median line, and left heart, 8.5 cm. from median line; total, 11.5 cm.

bodies in the cranial cavity have been located and removed. Fractures of the bones of the face are more clearly defined, whereas fractures of the cranial base are inaccessible to the rays, although bony formations resulting therefrom and encroaching on the cranial contents can be demonstrated. In diseases of the sinuses the rays assist the rhinologist in diagnosis. Even the dentist cannot dispense with the rays. In intumescences of the jaw differentiation can be made between tumors and inflammatory swelling, and in fractures the rays assist in reposition. Information concerning the presence or absence of deciduous teeth, deformed roots, etc., can be elicited.

The Neck.—Examination of the esophagus is facilitated by an examination conducted in the left oblique position, *i. e.*, when the rays are made to penetrate the chest obliquely, and is the reverse of the right anterior oblique position. In the clear space between the shadow of the vertebral column and the cardio-aortic shadow opaque substances introduced into the esophagus are more easily recognized than in the anteroposterior positions. By introducing a metallic sound, the direction and position of the esophagus can be recognized, and if a stricture is present, the arrest of the sound can be located. A capsule containing bismuth, which is opaque to the rays when swallowed, can also be seen to be arrested at the site of the stricture. To locate diverticula and ascertain other facts concerning the esophagus, a skiagram may be taken after the subject has swallowed an emulsion of bismuth, which coats the lining of the tube. It is often possible to say by aid of the fluoroscope whether the stricture is organic or functional. In the former instance the bismuth capsule is arrested at the strictured site, and in the latter instance the capsules glide at once without delay into the stomach. Among other conditions that yield to radio-diagnosis are: carotid and subclavian aneurisms, tumors of the larynx, foreign bodies, fractures of the hyoid bone, larynx, and vertebræ, calcified tuberculous cervical glands, etc.

Valobra[289] has noted in the treatment of non-suppurative tuerculous adenitis by the rays, using a hard tube at a distance of 30 to 40 cm. from the region to be treated, and protecting the surrounding skin by an aluminum shield, a decided reaction after each sitting. The reaction was characterized by fever, swelling of the involved glands, and general symptoms lasting some days. The latter symptoms were immediately followed by a rapid absorption and decrease in the size of the glands. Supernumerary cervical ribs are easily demonstrated by skiagraphs, and one must not forget their possible presence when symptoms arise referable to pressure on the brachial plexus and more or less complete occlusion of the subclavian artery. Grunmach[330] affirms that a supernumerary cervical rib was responsible for radiating pains in nearly 2 per cent. of his cases, and that the diagnosis was only made possible by radio-diagnosis.

Gall-stones and Renal Calculi.—Unfortunately the skiagram rarely reveals the presence of gall-stones, owing to the fact that the calculi are usually made up of organic substances, hence differentiation of the liver and the calculi is impossible. To facilitate skiagraphic diagnosis, a soft tube and a compression diaphragm are used, and the rays are made to reach the gall-bladder without having to traverse much of the liver parenchyma by elevating the upper part of the chest by means of cushions. Renal calculi are practically always accessible to radio-diagnosis by skiagraphy if a compression diaphragm and proper tubes are employed. One is also able to determine the size and position of the kidneys, as well as to demonstrate hydronephrosis, cysts, and tuberculous lesions if calcified. Calculi elsewhere in the genito-urinary apparatus are demonstrable by the rays. A clearer understanding can be elicited of the various types of spina bifida and foreign bodies are easily located. Examination for calculi should be preceded by thorough purgation.

Stomach and Intestines.—The lower border of the stomach can be defined by the rays after the patient has swallowed an emulsion of bismuth. Inflating the stomach with gas or air shows an indistinct clear area. The gyromele, in my experience, is the most satisfactory means of locating the position, outlines, and size of the stomach by means of fluoroscopy. Rubber-tubes are now sold which are equally impermeable to the rays, and hence they may be employed with greater convenience for locating the position of the stomach. Hulst, Einhorn, and others have succeeded in taking excellent Röntgenographs of the stomach by having the patient ingest on an empty or partially empty stomach a pint of milk in which one ounce of subnitrate of bismuth is suspended by thorough mixing. The patient is then skiagraphed at once, either standing or recumbent, with the photographic plate over the abdomen. The time of exposure with a good tube and apparatus is about ten or fifteen seconds. By exposing the patient to the rays on the following day, an excellent skiagram of the colon can be obtained. To secure better orientation in the skiagram, a coin is placed over the navel and a wire wound around the lower end of the ribs and the crest of the ilium. The anode is placed opposite the third lumbar vertebra; the patient rests the abdomen on the plate against a wall and breathing is suspended during the brief period of exposure. The lower part of the colon can be defined by injecting three ounces of bismuth up the rectum. Rieder claims that by injecting one liter of fluid containing bismuth it is possible to insure penetration as far as the ileocecal valve. Rieder advises when exact observations are necessary to give a meal composed of 30 grams of subnitrate of bismuth mixed with a little milk, to which is added 300 to 400 grams of flour gruel sweetened with milk-sugar to prevent constipation. By this meal he can diagnose an hourglass stomach, gastroptosis, dilatation, intestinal stenoses, dilatation or descent of the colon, etc. Satisfactory observations can be made by fluoroscopy. Schwartz[149] tests the digestive power of the gastric juice by having the patient swallow a pill containing ⅓ or ½ ounce of subnitrate of bismuth which is inclosed in an envelope of connective tissue obtained from the appendix vermiformis of some animal (sheep, ox, or goat). Later, the abdomen is exposed to the rays, and a deep black spot is seen at the bottom of the stomach. After digestion of the connective tissue the powder is scattered, and a fainter and more extensive shadow giving the contour of the entire organ is cast on the screen or photographic plate. Normally the connective tissue is digested seven hours after ingestion. In delayed digestion in consequence of gastric disease the black spot may persist for twenty hours, whereas if digestion is accelerated, as in hyperacidity, the black spot disappears within five hours.

An important matter concerning the use of the rays after the ingestion of bismuth is to study the activity of the stomach. Thus Tuffier and Aubourg[352] show that when the stomach contracts it recalls a Politzer bag rhythmically compressed by the hand. These contractions usually commence thirty minutes after the ingestion of a meal containing bismuth, and are very marked in a normal subject, recurring several times a minute. The contractions are very much diminished in cancer of the pylorus, and very feeble contractions may be followed by a violent one, as though the organ were striving in vain to overcome an obstacle. After the administration of a bismuth-meal, no shadow should be seen after three hours in males and 4 hours in females. By means of the shadow, it is possible to determine whether any area of tenderness is really associated with the stomach. If a growth of the stomach projects into the large air-bubble (always visible in the cardiac portion of the organ), it is distinctly circumscribed. The absence of peristalsis suggests infiltration of the stomach-wall, and antiperistalsis suggests a pyloric stenosis. The size, form, and position of the organ are best recognized when the patient is in the standing posture. Many authors agree that the fish-hook or siphon-form is the normal one. Hemmeter's observations upon the precipitation of bismuth in ulcer of the stomach have not been confirmed.

Hirschsprung's disease refers to an extreme dilatation of the sigmoid flexure, sometimes extending into the rectum or involving the colon. The patients are children who never have a stool without an enema. A radiogram of the bowel can be made out by an injection of bismuth and oil (one of the former to three of the latter) which is allowed to run high up.

Pyelography.—Voelcker and Lichtenberg[291] under this name describe the process of taking *x*-ray photographs of the pelvis of the kidney. In order to do this, the ureter is catheterized and the instrument is advanced until it has reached the renal pelvis. A 5 per cent. solution of colloidal silver is then slowly injected through the catheter by means of a suitable syringe until the patient complains of pain. There are marked individual variations in the amount of distention that the pelvis of the kidney will tolerate; thus, in one instance, the injection of 5 c.c. gave rise to severe colicky pains, while in other instances 50 to 60 c.c. could be introduced. The *x*-ray photographs are taken by means of Albers-Schoenberg's screen, and are said to be of satisfactory clearness. The authors have employed the method in eleven instances, ten of the patients being women and one a man. Four failures are recorded, owing to various causes. Schematic drawings indicating the noteworthy features of four of the radiographs are appended, and show dilatation of the renal pelvis, angulation of the ureter, and dilatation of the ureter. The authors believe that the procedure will be found of use in the diagnosis of displacements of the kidney, dilatation of the renal pelvis, disorders of the ureter, and perhaps of renal tumors also. The operation is not very painful, but is best preceded by the injection of a small amount of morphin. An ureteral calculus may be located by the method of A. B. Johnson: a flexible lead stylet inclosed in a ureteral catheter is introduced into the ureter and its course located by a radiogram. Kreissl accomplishes the same object by injecting into the catheter a 2% solution of collargol, which also outlines the pelvis of the kidney.

Bladder.—Röntgen ray photographs of the bladder when the latter organ is distended with oxygen give better pictures than when the organ in question is distended with fluid. The oxygen is generated from peroxid of hydrogen by the use of potassium permanganate, hence the oxygen is sterile. The use of gas instead of fluid is of decided advantage when the presence of calculi is suspected. Voelcker obtains excellent radiographs of the bladder by injecting into the viscus an organic solution of silver before making the exposure, and he has also thrown the solution into the ureter, as described above.

Prostate.—Recent reports seem to show favorable results associated with Röntgen-ray treatment in prostatic hypertrophy. The rays possess the property of causing atrophy of glandular tissue. Only a few sittings are necessary to determine whether the rays will do any good, insomuch as the symptoms are usually ameliorated after a single exposure. Hunter, who has recently reviewed the literature, employs a high tube with a current of two amperes at 110 volts, placing his patient in the Sims position and directing the rays upon the perineum after protection of the surrounding parts with lead-foil. In very old men he advises exposing the scrotum as well, as the good effects sometimes associated with a castration can be added to that of the direct exposure.

Pelvis.—A skiagram of the pelvis, by revealing asymmetry, ankyloses, contraction, etc., is of great diagnostic and prognostic importance in obstetrics.

Pregnancy.—Lichtenstein[224] believes that the presence of fluid in the tissues is one of the greatest obstacles to successful radiography and describes a case in which the diagnosis of extrauterine pregnancy was made before operation by means of an *x*-ray photograph. In discussing this case he points out that it is easier to secure a successful radiograph of an extrauterine fetus than of one contained within the uterus. In extrauterine pregnancy the fetal membranes are thinner and contain but little, if any, liquor amnii. If the pregnancy is advanced, the fetus usually emerges from the tube and finds a resting-place in the surrounding parts, so that the placenta comes to lie at one side; in the uterus, however, the placenta commonly overlies the fetus and offers an additional barrier to the penetration of the rays. In other words, the greater amount of fluid which is present in the tissues and surrounding parts in the normal pregnancy accounts for the difficulty that is experienced in securing successful radiographs in this condition. That even a comparatively slight difference in the amount of fluid contained in the tissues may be of considerable importance as regards the success of the radiograph is shown by the fact that if two radiographs are made of a still-born child, the one immediately after birth, and the other after the body has been preserved from twelve to fifteen days, the skeleton will be much more clearly marked on the second plate, owing to the dehydration of the tissues that has been effected by the preserving fluid.

Arteriosclerosis.—In crural angiosclerosis rheumatic pains or intermittent claudication may be the only symptoms, yet a skiagram reveals sclerosed arteries and veins and thus establishes the diagnosis.

Fractures.—Radio-diagnosis is of great importance in the diagnosis and treatment of fractures, yet there is always danger of misinterpreting a skiagram. Hall-Edwards[150] makes many pertinent suggestions respecting this matter. He refers to the importance of examining the plates themselves rather than a print, as no process of reproduction has yet been devised that will bring out distinctly all the details of a good negative. The best way of examining negatives is to have a large sheet of ground glass let into one of the windows, preferably one which has a sky exposure. Next to this an ordinary retouching desk will answer, using a sheet of cardboard or white paper as a reflector. Sometimes when the negative is thin it may be examined at different angles. He emphasizes the necessity of special skill in examining radiographic plates. He says that in *x*-ray work the shadows of the bones are examined in positions to which we are unaccustomed when handling the bones, hence it is absolutely necessary for a proper interpretation of a radiograph that the individual should have a knowledge of the normal aspect of a part as depicted by the *x*-rays. Prior to the introduction of the *x*-rays there was no means of viewing a joint in the various aspects assumed during normal movement, hence it is difficult to grasp the situation when these structures are presented in the new aspect. The hip-joint is especially difficult in this respect, unless all of the circumstances under which the radiograph was produced are known. In radiographs of the hip and pelvis, distortion and faulty interpretation are extremely frequent. It has been shown that the angle between the neck and the shaft is correctly brought out only when the feet are rotated inward. In Edwards's experience it is better, except in very young children, to make a separate plate of each hip. After some comment on the present anomalous position of the surgeon *x*-ray expert, the writer says that at present he has to compete with the tradesmen, who are to a large extent supported by the medical profession. Surgeons are to be blamed for this state of things, for as long as they accept radiographs from unknown sources, so long will the public support irregulars in this work. In closing he refers to Golding-Bird's question: "Can a radiograph show a fracture where none exists?" and he answers as follows:

1. Epiphyseal lines have been mistaken for fractures.

2. Impacted fracture of the neck of the femur can be imitated by taking a foreshortened view.

3. Fracture through the base of the olecranon is simulated always where the light is directly over the bend of the elbow, the plate being posterior. The band of light is due to the rays penetrating the joint. A lateral radiograph destroys the illusion.

4. The acromio-clavicular joint resembles a fracture. In case of a clavicle being radiographed to show a genuine fracture, this joint was mistaken for a second fracture by a medical attendant.

5. To imitate fracture by sudden break of the bone-outline is hardly possible in practice, but the appearance of a gradual thickening of bone can be produced at will. One observer records this thickening to have looked like a Colles fracture, but the other visible signs could not have been present.

Bones and Joints.—The resistance of bones to the rays is caused by the preponderance of earthy over animal matter in the proportion of 67 per cent. of the former to 33 per cent. of the latter. Any change in the bone modifying its density will yield a corresponding modification in its shadow. In the early stages of osteomyelitis a skiagram may yield the earliest diagnostic sign by the presence of a light shadow enveloped by a denser one. Demonstration of the site of the lesion prevents much unnecessary surgery. Phlegmonous processes often involve the neighboring bones, and the degree of such invasion may be determined by the rays. In tuberculosis of the bones the shadow-density is modified in the early stages, hence an early diagnosis is possible and the site of predilection is the epiphysis. The shadow of a tuberculous joint is usually irregular and diffused. In taking skiagrams of joints, Hoffa[151] forces into the interior of joints aseptic oxygen, which he declares is not only harmless, but in certain cases beneficial. The oxygen casts no shadow and the parts stand out in relief against a white background, while the distention from the oxygen differentiates the various parts. This is by no means a harmless procedure, insomuch as Jacobson, of Breslau, reported a case of death a few hours after insufflation of oxygen into the knee-joint. Hölzknecht reported a similar case, and a considerable amount of gas was found in the heart. The lesions in rickets and osteomalacia are demonstrable. Joint affections either show no anatomic lesions or they are demonstrable in gonorrhea, syphilis, etc. In the differential diagnosis between gout and rheumatoid arthritis the rays are important. In gout the deposit of uric acid salts in the articular cartilages and ligaments, throws a shadow of considerable density on the plate, whereas in rheumatoid arthritis the heads of the phalangeal and metacarpal bones are eroded and show punched-out cavities, and the outlines of the bones are blurred and more translucent. Bone-tumors are likewise amenable to radio-diagnosis. In the differential diagnosis of syphilitic bone disease and chronic osteomyelitis, the *x*-rays in the former condition show a uniform dark shadow, while in the latter affection there are dark shadows with clear spaces corresponding to sequestra and abscesses respectively.

Foreign Bodies.—It is difficult to locate a foreign body in the usual way because the ordinary *x*-ray plate looks flat. Carothers[290] observes that stereoscopy as applied to radiography, called stereoskiagraphy, is the most improved method, and seems to give the most accurate location of a foreign body. This idea has been worked up by many radiographers in different parts of the country independently of each other. The stereoscope gives a perspective view very much as if the parts (bone and bullet) were before one in nature. Two separate plates are made of the same part without changing in the least the position of the part skiagraphed, which is placed on the compression diaphragm table, the compression diaphragm itself being discarded, on a hollow board or plateholder, with a metallic bottom, so that the rays might be partially obstructed, and in this way one plate can be removed and a second supplied. The tube is held in the tube-holder, and with the use of a plumb-bob it is carefully centered through the center of the part to be skiagraphed onto the center of the plate. The plates are made with the tube placed one and three-eighths inches to either side of this central point, so that they are made from points two and three-quarter inches separated from each other, corresponding to the distance between the human eyes. The developed plates are placed in highly illumined boxes facing each other, and are from them reflected into two small looking-glasses, which are placed at a right angle to each other, with the apex of the angle placed between the eyes of the observer in the stereoscope. One now looks into the two looking-glasses, each eye in a separate glass, as a separate plate; then by adjusting the plate and the stereoscope to get an exact focus, the two plates are made to look as one, and it would appear that there was one looking-glass behind which the observer looked, reflecting the object back onto the retina, producing a perspective view. This method is of special value in locating foreign bodies in the spine, thorax, or abdomen, where it is almost impossible to get a plate which is not flat by any other method.

Sinuses.—Iodoform casts a shadow, hence an emulsion of this drug injected into a sinus is employed when a picture of the sinus is desired.

The success of a surgical operation on *fistulous tracts* depends largely on the extent and direction of the sinuses before the operation, and radiographs taken after the fistulas have been injected with bismuth paste show this perfectly. The fistulas should be as clean as possible before the injection. The bismuth paste, mixed with wax or soft paraffin and injected in a liquid state, solidifies the fistula and serves as a framework for new connective tissue. The paste is absorbed and the fistula obliterated provided no sequestra are present, and which must be removed before the injection. The formula of paste for diagnosis and treatment consists, according to the method of Beck, of bismuth subnitrate 1 oz. and vaselin 2 oz.; these are mixed while boiling.

Stengel and Pancoast[375] reason that in *leukemia* the bone-marrow is the actual seat of the disease, and that the spleen is secondarily enlarged, hence they expose every portion of the skeleton to the action of the rays except the cranium. After this manner the spleen diminishes in size gradually without direct exposure.

Exposure of the dorsal region (five minutes daily) to the *x*-rays in *locomotor ataxia* is of benefit in the gastric crises (Bramwell), and I have in several instances succeeded in securing relief of the neuralgic pains in the pre-ataxic stage by the same use of the rays.

Radiography has been employed as a diagnostic sign of *death*. In the living subject the stomach and intestines are not visible, owing to their transparency and continuous movements. On the contrary, in the dead subject a clear radiograph of these organs may be obtained. The gases in the latter subject, owing to the presence of sulphur, become phosphorescent under the action of the rays, and thus reinforce the latter. Béclère observes that radiographs of persons with abdominal meteorism or paralytic distention of the bowel may yield the same results, hence he questions the value of the radiographic diagnosis in question.

RUBBER BANDAGE.

Latent Roseola.—Horand,[152] by applying a rubber bandage or any other suitable substitute to the upper part of an extremity so as to increase intravenous tension, notes that the eruption in this disease, which escapes the ordinary methods of examination, becomes evident. This method is no doubt applicable when indistinct cutaneous lesions are present in other conditions. (*Vide* chromo-diagnosis, page 37.)

Raynaud's Disease.—This is a vascular disorder with three grades of intensity: viz., local syncope, in which the fingers or toes exhibit pallor (dead fingers or toes); local asphyxia, in which parts of the extremities show swelling and congestion with excruciating pain; and local or symmetrical gangrene, in which there are necrotic areas. The prevailing theory in explanation of this disease is vascular spasm. If vascular spasm exists, then the results attending Cushing's treatment[153] are diagnostic. By applying a rubber bandage to the upper part of the affected extremity for several minutes it will be noted that hyperemia and augmented surface-temperature follow removal of the bandage, due presumably to a temporary paralysis of vasomotor control of the part below the encircling bandage. If the bandage relieves the symptoms, or if a pulse previously impalpable becomes palpable, the nature of the lesion is probably a vascular spasm.

Contractures (*vide* page 209).—The physician is compelled to recognize as hysterical in character all spasmodic contractures which cannot be explained by a central or peripheral lesion. A contracture of the muscles may be due to shortening and distortion (permanent), as from shrinkage of muscles, or it may be spasmodic (temporary). The former are also known as passive and the latter as active contractures. If the contracture involves an extremity, by the application of a rubber bandage for a time not exceeding twenty minutes the bandage-like narcosis will cause active contractures to disappear, but it is without influence on the passive forms. Cures have resulted from the application of the bandage. All active contractures yield temporarily to the application of the bandage, and hysterical cannot be distinguished from non-hysterical forms.

The rubber bandage has also been used and cures have resulted in inhibiting the contractures and spasms of **writer's cramp.** Here the bandage, after the elastic ligature method of Bier, must be applied about the arm above the biceps muscle for twenty minutes night and morning (Hartenberg).

Arterial Occlusion.—It is often difficult to determine the site of arterial obstruction in gangrene from arterial thrombosis or embolism as a prelude to operative interference. Here the method of Moszkowicz[154] may be used. A bandage is applied after the method of Esmarch and the parts rendered anemic for five minutes. After the removal of the bandage in the norm, a vivid hyperemia occurs in several seconds. In individuals with circulatory troubles the hyperemia advances quickly to the knee, and then two minutes elapse before the hyperemia attains the toes. In arterial occlusion the hyperemia is arrested at the point of obstruction, at which site amputation is practised when necessary. An important question to be decided is whether or not it might be wiser to take the flap on the side where the hyperemia extends farther downward. Moszkowicz first raises the leg to expel the blood, then applies energetic constriction with an elastic band, as high as possible on the limb, and leaves the tourniquet in place for five minutes. On removal of the band the circulation is rapidly restored throughout the limb, even in cases of arteriosclerosis, if the blood-vessels are permeable. When the circulation is seen to be sufficient all through the leg except at the toes, expectant treatment is indicated, allowing the toes to drop off, as in cases of gangrene from freezing, or the whole or part of the foot can be amputated. But if the circulation is seen to be arrested above, the leg should be amputated without delay, above the point where the active hyperemia is arrested. If amputation is refused, by repeating the test the course of the case can be supervised and the development of occlusion from thrombi higher up can be determined. The patients can see for themselves the results of the test, and it simplifies matters. Even with mere narrowing of the arteries, as in case of intermittent claudication, the active hyperemia test gives very instructive findings.

In gangrene the question of spasm of the vessels must not be ignored, and a case[320] is cited of gangrene of the hand successfully treated by nitroglycerin tablets. Amyl nitrite by inhalation would at once exclude in the diagnosis the spasmodic vascular factor. In gangrene when an amputation has been performed and the rubber band removed, no bleeding would indicate a clot in the vessel, in which case a fine catheter inserted into the artery will break up the clot and cause the blood to flow. Moszkowicz recommends the frequent application of the bandage when indicated as a method of arterial gymnastics to ameliorate the collateral circulation in arterial occlusion. The hyperemia test will direct attention to circulatory affections of the extremities which are often erroneously attributed to joint affections, flat-foot, varices, or hysteria.

Joints.—Noccioli concludes: (1) Cases of hydrarthrosis apparently cured in which the effusion reappears after application of the bandage, show that the cure is not absolute. (2) In effusion into the knee the bandage, by forcing fluid into the superior cul-de-sac under the patella, and by relaxation of the quadriceps, shows the presence of small quantities of fluid. (3) When the edema and hyperemia resulting from the application of the bandage show nothing in particular concerning intensity and localization, involvement of the blood-vessels and lymphatics of the joint can be excluded.

In **tachycardia** the employment of a tight bandage around the abdomen by overcoming distention of the abdominal vessels often gives great relief.

Goldthwaite[377] attributes many **backaches** in women to a sacroiliac dislocation. The sacroiliac articulations are veritable joints, and are by no means as stable as has been supposed. The pains in this condition may be localized in the sacral region or referred to the extremities. The pain is worse on lying upon the back, because flattening of the lumbar spine strains the sacroiliac ligaments. Very often the patient is relieved at night by lying on a firm bed with a firm hair pillow under the hollow of the back. In more severe cases the luxation may be corrected by extending the spine, the legs resting on one table and the head and shoulder on another, with the face downward and the body hanging unsupported between. The sacrum is thus replaced and a plaster jacket is applied. In some cases pelvic support is obtained by a wide webbing belt attached to the base of the corsets and kept up by the insertion of light steels.

When the **kidneys** are not secreting a sufficient amount of fluid, their blood-supply may be augmented by bandaging the limbs, and thus forcing more blood into the trunk. The elimination of water and chlorids is increased from 50 to 100 per cent., while the organic substances are not affected (Plessi).

In **lumbago** strapping from the thigh upward with layers of adhesive plaster which overlap often gives instantaneous relief, and for this reason one is able to exclude lumbar pains of other origin.

Varicose Veins.—There are individuals who suffer from pains in the lower extremities ranging all the way from so-called rheumatic to sciatic pains. In such instances deep-seated varices may be at the foundation of the trouble without any evidence of changes in the superficial veins. These varices are often overlooked, especially in the etiology of sciatica (Fig. 93). When relief follows the wearing of a rubber bandage for several days in obscure pains of the lower extremities, the existence of varices may be suspected. Even when the varices are superficial the bandage gives relief and prepares the way for more radical measures. A flannel roller or a perforated rubber bandage may be applied over a long stocking.

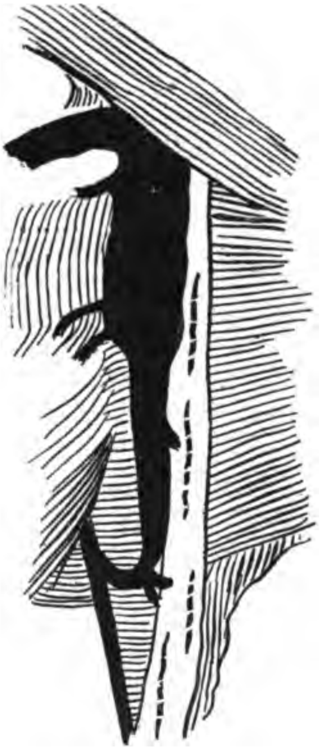


Fig. 93.—Varicose veins (shaded) in sciatica.

Venous Sufficiency.—To test for insufficiency of the valves in the saphenous vein, the leg is raised passively as the patient sits up in bed, with his back supported. After the blood is massaged out of the leg, the latter is lowered. The blood will rush back into the leg, filling all parts that are below the level of the heart. In this connection the test of Schwartz may be cited to demonstrate insufficiency of the valves. The dilated vein is struck lightly and its outline noted against the light. If the valves are insufficient, a wave spreads rapidly along the vein to a considerable distance, while it is soon arrested, if the valves functionate properly. Trendelenburg's test: The patient having been placed in the recumbent position, the limb is raised so as to empty the superficial veins. The fingers are then made to press firmly the long saphenous just below the saphenous opening, and the patient allowed to stand. When the pressure is suddenly removed and the empty vein is again distended, it indicates valvular incompetency of the vein. Delbet has shown that a saphenous vein, although appearing of normal size, may still be in a condition of valvular insufficiency. In the latter case, if the fingers are placed upon the vein at some distance below the saphenous opening, a thrill will be felt immediately when the pressure is removed, although there may be no visible dilatation of the vein.

Respiratory Apparatus.—When it is necessary to increase the respiratory activity of the apices for auscultatory purposes, the rubber bandage applied to the lower chest is indicated. If we desire to inhibit the apical movements in hemoptysis, the bandage is so wound around the upper chest that it includes one or both supraclavicular regions. The accompanying *x*-ray tracings (Figs. 94 and 95) show the apical areas before and after the application of a rubber bandage.

The employment of traction-plasters, as advocated by Dennison, of Denver, for restricting the respiratory mobility of the affected lung is a simple method worthy of trial in hemoptysis and for inhibiting pleural pains. The method is, in brief, as follows: Thick and firm plaster which will not wrinkle on pulling is selected, and cut as shown in illustration (Fig. 96). The gauze covering the plaster is detached partially, to the extent seen in the unshaded portions of cuts, and a well-padded collar made of muslin is made to fit the shoulder. The mode of application of the two plasters and their attachment by aid of safety-pins to the collar after sufficient traction is made can also be seen in Fig. 96, which illustrates the method of strapping the left side of the chest. Dennison's method of immobilization is an excellent one, as I have repeatedly demonstrated to my own satisfaction by aid of the Röntgen rays.

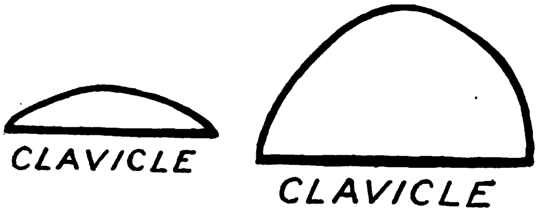


Fig. 94. Fig. 95.

Figs. 94 and 95.—Fig. 94, the fluoroscopic area of the pulmonary apex before, and Fig. 95 after, the application of the rubber bandage to the lower chest.

Edematous deformity of an extremity may be confounded with *elephantiasis*, but its disappearance under the application of a bandage from the fingers or toes upward suggests its edematous origin.

Compression of an extremity with an Esmarch bandage or a tight bandage has been followed by *ischemic paralysis*. The latter is an ischemic myositis characterized by paralysis and contraction which occur simultaneously.

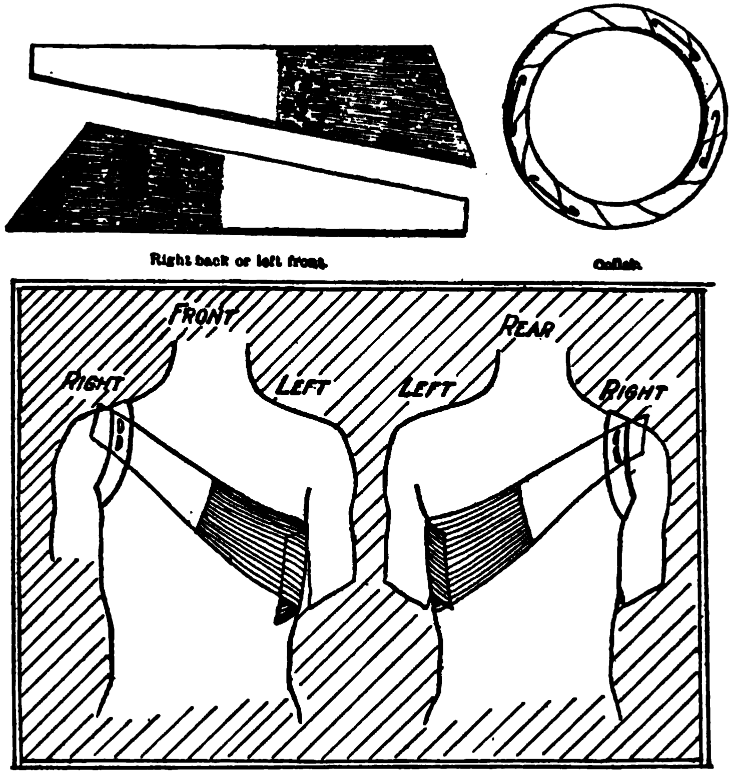


Fig. 96.—Illustrating Dennison's method of restricting respiratory mobility in hemoptysis and pleuritis.

Shock.—Bandaging the extremities will often relieve this condition. The procedure is known as *autotransfusion;* it increases peripheral resistance and permits the body to employ the small amount of circulating blood and send it to the brain to maintain circulation and respiration. Another excellent method in shock or collapse is the application of a distended rubber bag to the abdomen, secured by a bandage. The latter procedure drives a considerable quantity of intra-abdominal blood into the general circulation My abdominal compressor (Fig. 118) is a simple and efficient apparatus for the same purpose.

SOUNDS.

Esophagus.—In introducing the esophageal sound a slight physiologic resistance is encountered at the level of the cricoid cartilage. Other narrow portions are at the level of the tracheal bifurcation and at the esophageal opening in the diaphragm. Naturally the tip of the sound must be thoroughly lubricated. *Stenoses* are easily demonstrated. Above all, one must exclude spasm of the gullet (esophagismus) in neurotic subjects. Globus hystericus is an esophageal spasm. When the spasm involves the lower end of the gullet, it is called cardiospasm. While in functional spasms, as a rule, solids and even liquids are rejected, only slight resistance or none at all is offered to the sound, and a cure may even be effected after a single introduction. Obstructions due to stricture are in about 85 per cent. of the cases caused by a tumor. The location of the latter is important. The site of the growth in 50 per cent. of the cases is near the cardia, in 40 per cent. opposite the tracheal bifurcation, and only 10 per cent. in the upper part of the gullet. The following measurements assist in location:

Distance from the incisor teeth to the entrance of the gullet..............	15 cm.
Distance from the incisor teeth to the bifurcation of the trachea..........	25 cm.
Distance from the incisor teeth to the cardia...........................	40 cm.

Fragments of the growth may adhere to the sound and can be examined microscopically. The consistence of the stricture may be determined by the resistance, and noises are produced when the sound comes in contact with foreign bodies. The degree of stenosis is determined by sounds varying in size. Pain experienced when the sound reaches a definite point assists in the location of the lesion.

Food passes from the mouth to the stomach in about four seconds. Ogston's method of estimating the time of deglutition is to place the ear just below the angle of the left scapula; place a finger on the patient's Adam's apple and hold a watch in the other hand. After the patient drinks some water, count the time from the moment the Adam's apple begins to rise until the fluid is heard to gurgle into the stomach. In stenosis of the esophagus some of the fluid is retained above the stricture, and every time the patient makes a movement of swallowing without really swallowing anything (not even saliva), a second sound is heard until all the fluid has passed through the stricture (Revidtzev). By having the patient drink a glass of water, it is evident that the more water ingested before regurgitation, the lower down is the stenosis.

Patients with traumatic or cancerous stenosis of the gullet, according to Gerhardt,[156] are relieved to a remarkable extent by small doses of morphin before meals. Here it must be remembered that the stricture or any attempt at swallowing augments the stenosis by spasmodic closure of the lumen. Morphin in such instances excludes the spasmodic element. Tonic spasms of the esophagus may be reflex, from cancer of the liver or stomach or from inflammatory throat affections, epilepsy, tetanus, etc. In spasmodic stenosis, if the bougie is held against the obstruction, the spasm often relaxes after a time and permits the instrument to pass; however, in all instances a bougie can be passed during anesthesia. A *diverticulum* of the esophagus may or may not be associated with a stricture of this structure. If the diverticulum is in the neck, a lump forms during deglutition which may be dispersed by pressure. When the pouch is full, the bougie can usually be passed. A diverticulum may be skiagraphed by having the patient swallow food mixed with subnitrate of bismuth. The Rumpel test for diverticula of the esophagus and the differentiation of the latter from dilatation is as follows: A tube with lateral openings is introduced into the stomach, while a second one is passed into the diverticulum. If dilatation exists, colored fluid poured into the tube at the point of enlargement will flow through the lateral openings into the stomach. If a diverticulum is present, nothing will flow through the lateral openings into the stomach. If a diverticulum is present, nothing will escape out of the tube into the stomach, while from the tube in the diverticulum all the fluid poured in will be recovered.

An impacted mass of food in the esophagus may be disintegrated by a mixture containing pepsin (Maylard).

Prophylaxis.—The sound must be used with great gentleness and little pressure exerted, as instances are on record where the sound has perforated the gullet. If aneurism of the aorta is suspected, the sound should not be employed. The ordinary stomach-tube may be used in lieu of a sound. Whistling noises heard when the sound is introduced cease when the stomach is reached. If the larynx has been entered, dyspnea at once follows.

Rectum.—In obstructions situated within the reach of the finger the latter is more satisfactory than a rectal bougie, whereas in obstructions beyond the reach of the finger it is often difficult to say whether the bougie is impeded by a physiologic or pathologic obstruction. When an abnormal irritability of the sphincter muscles is suspected as a factor in constipation, gradual dilatation of the sphincter may be tried. Many cases yield to gradual dilatation, but, of course, here there is always a psychic factor at work. In examining the rectum, one can feel the prostate, base of the bladder when full, and the vesiculæ seminales in the front of the rectum; in the female, the cervix uteri can be felt through the rectal walls projecting back toward the sacrum. The sacrum and coccyx can be felt behind and the tuberosities and ischial spines at the sides in both sexes. Any symptom associated with the rectum demands a rectal examination. Leube is very emphatic on this point. His observations show that hemorrhoids are rarely absent in carcinoma of the rectum, and that if they are present, it is his invariable rule to make a rectal examination. In this way he has frequently discovered neoplasms of the rectum in which the symptoms were latent. In the use of sounds in the treatment of stricture of the rectum one must remember that ulceration of the bowel above the stricture may be present, hence care must be exercised in the use of bougies. Examination of the prostate shows an acute prostatitis if the gland is hot, tender, and swollen; a prostatic abscess, if it is soft and fluctuating; if firm and rounded, hypertrophy; if irregular in outline and very large, and associated with hematuria and enlarged pelvic and lumbar glands, malignant disease; if nodules are detected and the individual is young, tuberculosis should be suspected.

Urethra and Bladder.—In examining the urethra for a stricture acorn or bullet-headed graduated probes are used. In urethral examinations spasms (page 154) must be excluded. One must also exclude swelling of the mucosa (congestive stricture) by the preliminary use of adrenalin. A grating sound suggests a urethral or prostatic calculus, and the site of the grating distinguishes one calculus from the other. If the instrument deviates from the median line or passes its full length without attaining the bladder, a false passage must be suspected. In prostatic hypertrophy the instrument may pass its entire length without reaching the bladder.

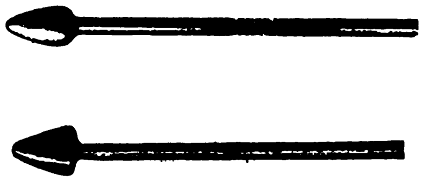


Fig. 97.—Bougie à boule.

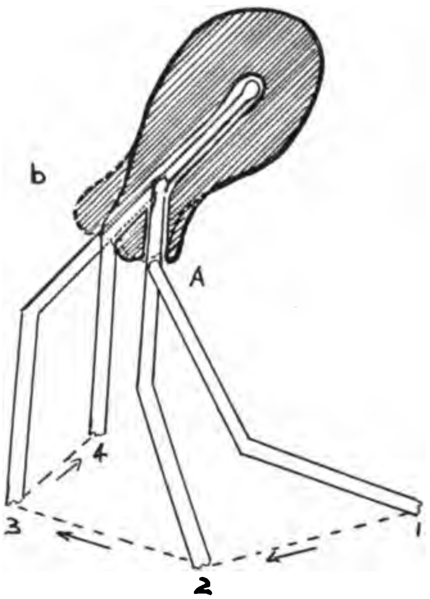


Fig. 98.—Illustrating the method of passing the sound into a normal uterus, after Giles. The successive positions are shown as 1 to 4. *A*, The cervix in its normal position; *b*, position of cervix when it is drawn back into line with the body of the uterus.

One of the best instruments for exploring the urethra is a soft *bougie-à-boule* (Fig. 97), and when the latter is withdrawn, the shoulder engages in any contraction which may be present. When the instrument is introduced into the posterior urethra, its withdrawal is hindered in the norm when its shoulder comes in contact with the posterior layer of the triangular ligament. The emergence of the bougie is not only arrested by a stricture, but likewise by any pathologic condition which diminishes the urethral caliber (indurated patches, granular areas, papilloma). Among the different methods for obtaining pathologic products from the urethra when the secretions are scanty is to introduce an olive-tipped sound, and at each place where the sound shows some engagement the part is massaged from the outside and the secretions squeezed out over the olive-tipped sound.

In examining the bladder for calculi the hips should be raised, insomuch as calculi fall into the lower fundus; use a sound with a small beak, so that the instrument can be easily rotated in the bladder; examine the organ in its distended and empty condition. An audible click indicates a calculus. If the stone is felt to be smooth, it is most likely a uric acid calculus; if rough and nodular, oxalate of lime; if soft, a phosphatic calculus. One is also able to determine the size, position, and number of stones. A resistance felt in the bladder when the instrument is rotated directs attention to a growth: a soft resistance may indicate a papilloma, and a firmer resistance, a carcinoma. If a hollow sound is used, fragments of the growth may be found in the eye of the instrument. A small stone may be found occasionally by using a Bigelow evacuator, the current causing the calculus to strike against the tube. The *cystoscope* and the *x-rays* are invaluable for detecting calculi.

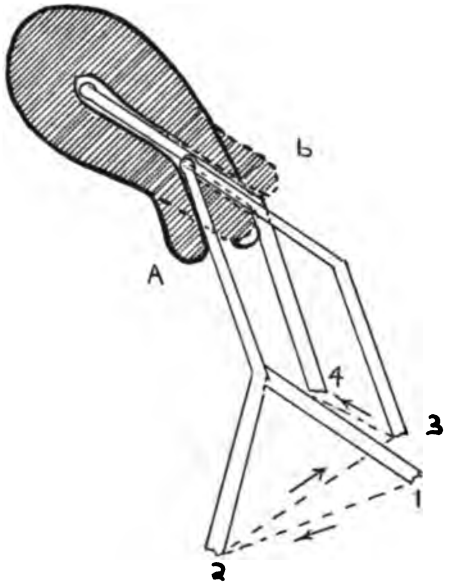


Fig. 99.—Diagram of the successive stages (1 to 4) in passing the sound into a retroverted uterus. *A*, Position of the cervix in the first and second stages; *b*, position of the cervix in the third and fourth stages.

In females, in whom calculi are infrequent, a straight sound is used for exploring; the urethra may be dilated and the bladder examined with the little finger. Consult catheterism (page 418). Jacobson employs a Thompson searcher attached to the front of a telephone transmitter through the medium of a plug-joint. This lithophone is said to be so delicate that no stone, however small, will escape detection, and that the character of varying surfaces may be differentiated by rubbing the end of the searcher over them.

Uterus.—The uterine sound is graduated in inches and is used for determining the length of the uterine cavity, the position and direction of the uterus, and in effecting reposition of the organ.

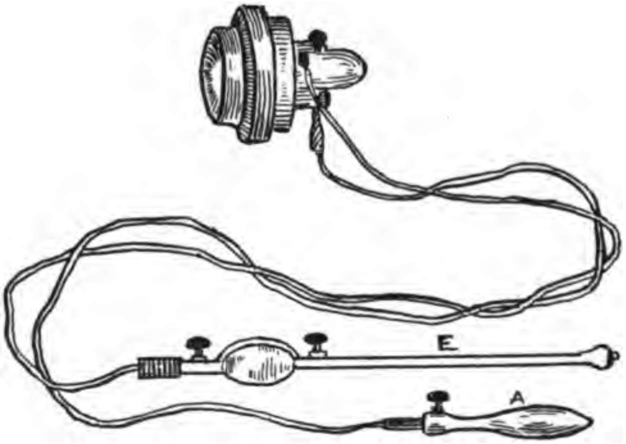


Fig. 100.—Girdner's telephone bullet-probe.

In using the sound Giles[156] recommends ascertaining, first of all, the position of the uterus by bimanual examination. With the picture of the position in mind and the guiding finger in the vagina giving indications, the point of the sound is directed toward the fundus. The manipulation is easier when two fingers can be introduced into the vagina and are so placed that the os externum forms a continuation of the groove between the fingers. Reference to Figs. 98 and 99, from Giles, illustrates the methods of passing the sound.

Bullet-probe.—This instrument, devised by Girdner, is used for locating metallic masses in the body. The electric current operating it is derived solely from the body of the patient. When the probe touches the metal, the battery is complete, and the current passing through the receiver causes a clicking, grating sound. The bulb A (Fig. 100) is placed in the mouth, rectum, or vagina. The receiver is held to the ear of the operator and the probe E searches for the metallic body.

Lilienthal's probe for locating a bullet consists of a mouth-piece, two insulated copper wires, and a probe. The operator closes the teeth upon the mouth-piece, and when the probe in the wound touches the bullet, a metallic taste is appreciable. It was formerly possible to distinguish a leaden bullet by inserting the asepticized stem of a clay pipe, Nélaton's porcelain-headed probe, or a piece of pine wood, on the ends of which a black mark could be seen. The modern bullet with its hard metallic jacket leaves no such mark on a white substance.

STRAPPING.

Abdominal.—Reference has already been made (page 407) to relaxation of the abdominal muscles as an etiologic factor in splanchnoptosis. Rose has given special study to anomalous gastric secretion associated with relaxed abdominal musculature. The condition usually prevailing is hyperchlorhydria, a constant symptom of which is paroxysmal pain two or more hours after meals. Burning in the stomach may precede the paroxysm. In these cases the following regimen of Illoway for hyperacidity is used:

Breakfast: Milk, two hard-boiled eggs, bread and butter. Two hours later a Vichy tablet in half a glass of water.

Lunch: Chops or steak, roast beef or roast mutton, bread and water; if desired, a little potato or rice. Two hours later a Vichy tablet in half a glass of water.

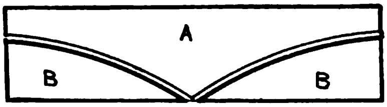
Dinner: A little soup, broiled fish, roast beef, roast mutton or roast chicken (only occasionally), a little potato, a small dish of some vegetable.

At bedtime: A glass of Vichy or milk, or a sandwich of cold beef or cold mutton, or cold chicken.

Forbidden: Anything ice cold or very hot, stimulants of any description, spices, tea, coffee, cocoa, all sweet things, fruit and tobacco.

Rose's method of strapping the abdomen is palliative and curative, and it is at least a diagnostic method for determining whether relaxed abdominal muscles are implicated in the production of gastric or other symptoms. The plaster is worn for five weeks and is without discomfort to the patient. Z. O. adhesive plaster on moleskin is used, seven inches wide and as long as the circumference of the waist measure of the patient. This plaster is cut into three pieces according to figure. The abdomen is shaved and washed with ether. The large piece is first applied, the point being placed over the symphysis, the ends meeting and overlapping in the back. The plaster should be applied above the crest of the ilium. Then the side-pieces, which run from the hypogastrium over the iliac and inguinal regions and unite at the spine, are applied with considerable force (Figs. 101, 102, 103).

Fig. 101.



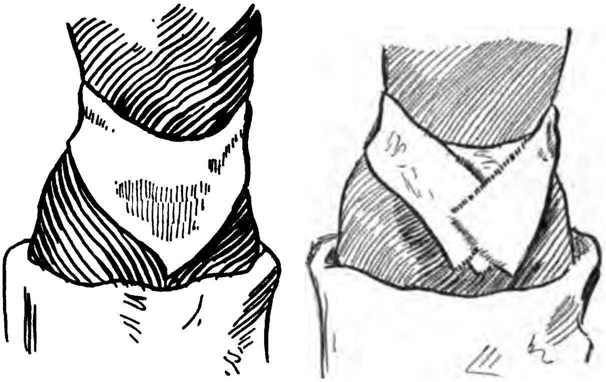


Fig. 102. Fig. 103.

Figs. 101, 102, and 103.—Illustrating the method of Rose in the application of the plaster-bandage: Fig. 101, Method of cutting the plaster; Fig. 102, showing the method of applying strip *A*; Fig. 103 showing the application of strips *B*,*B*, which complete the bandage.

In **sacroiliac disease** the relief obtained by fixation of the pelvis by straps of adhesive plaster directs attention to the genesis of the pains.

In **pertussis** the use of an abdominal support, as suggested by Kilmer,[208] is useful in infants and children to prevent excessive vomiting. This writer claims a reduction of 85 to 95 per cent. in the vomiting spells. The belt is made of linen, with a strip of silk elastic webbing, two inches wide, inserted on either side. The belt laces in the back, and the degree of constriction may be varied by the lacings. The length of the belt should be three inches less than the circumference of the abdomen at the umbilicus, and it should extend from the axillæ to the pubes. It is applied over the undershirt.

In women **affections of the breast,** especially pendulous breasts, must be excluded as a cause of some obscure thoracic pain, and here a suitable mammary binder is indicated. The handkerchief bandage consists of a handkerchief folded as a triangle, tied obliquely over the chest with its base under the breast, and fastened by safety-pins to a strip of muslin or bandage tied around the waist. One may be applied to each breast. The Murphy binder is made from a straight piece of muslin with a notch for the neck and two deeper notches for the arms. It is applied over the breasts, the ends being pinned in front. The double Y-bandage is made with two or three toilet napkins, folded lengthwise so that each is 32 inches long by 3 inches wide. A V is formed by making a diagonal fold in the middle of one or by pinning two together. To the apex is fastened one end of the other napkin, which is passed across the back and fastened by pins to the free ends of the other napkin or napkins, which are carried across the chest, one above and the other below the breasts. Slipping of the bandage may be prevented by adding shoulder-straps and by fastening it to an abdominal binder.

In **varicocele** a correct scrotal support is useful in diagnosis and treatment.

It may be necessary to determine quickly whether a *flat-foot* (page 1000) is responsible for certain symptoms. Here strapping of the foot by means of Z. O. adhesive plaster may be used. Prior to the application of the straps, the foot is placed in the position of dorsal flexion and supination, and this posture must be maintained by the straps.

Lumbago.—To exclude the muscles as a cause of lumbar pains place the patient in a position to relax the muscles of the back, and after washing the skin with alcohol, bind the lumbar muscles with strips of Z. O. plaster vertically along the spine, obliquely across the loins, and transversely across the muscles. This maneuver is also curative in lumbago.

As a rule, when an organic *arthralgia* is immobilized the pain is lessened in severity, whereas in functional arthralgia the pain is uninfluenced or increased in severity.

The Hand.—Fixing the hand on a particular part of the thorax with the object of eliminating a given area from participation in respiration is an excellent means of determining whether strapping will relieve pain. Similarly, when dysphagia is supposed to be caused by a rheumatic involvement of the cervical muscles, pressure on such muscles during deglutition will be unattended by pain. In the manipulation of a joint the pain, if myogenic, can likewise be excluded by the same maneuver. Thoracic pains increased by breathing may be dependent on tuberculosis of the apex of the lung and, if the upper part of the chest is fixed by the hands, the pains are no longer elicited. Peritoneal adhesions of the viscera intensified by abdominal breathing are ameliorated when the hands, by compression of the abdomen, cause the patient to practise costal breathing.

SUSPENSION.

When the suspension treatment was first advocated for the treatment of locomotor ataxia, it was employed indiscriminately and soon passed into desuetude. With this treatment the patient is suspended in a Sayre apparatus. It was found later that the vertebral column could be stretched by having the patient sit on the floor or a table and then forcibly flexing the head and trunk upon the thighs, while the lower extremities were kept straight. I still employ the original suspension treatment in locomotor ataxia, and find it an invaluable method for the relief of pain, bladder disturbances, and impotency in a number of instances. Rebellious cases of sciatica are often caused by a chronic arthritis of the vertebral column. In such instances suspension will often relieve and in other instances aggravate the pains. In either event suspension is diagnostic, insomuch as vertebral traction is without influence on the average sciatica. Very often suspension must be supplemented by traction on the lower extremities while an assistant makes counter-support at the shoulders of the suspended subject. The method is curative when adhesions are present in the vertebral articulations. Many painful affections referred to as lumbago have a like origin and are similarly influenced by suspension. The pain of dorsal caries may be relieved by suspending the patient from the shoulders or by traction on the head in cervical caries.

TAMPONADE.

Foster's lamp-wick tampon may be employed for diagnostic purposes. The old-fashioned lamp-wick wound in balls is used. A single strand of the wicking is introduced into the vagina through a speculum. When sufficient has been inserted, the wick is cut off at the vulva, leaving the end protruding and thus facilitating its removal by the patient. The tamponade can substitute a pessary when uterine or ovarian support is necessary in inflammatory conditions. It can be employed diagnostically for the same purposes as the pessary (page 576). When a retroverted uterus is fixed by adhesions, frequent applications of the glycerin tamponade gradually cause absorption of the adhesions. In prolapse of the uterus the tamponade retained by a T-bandage often gives more relief than any other support. Many chronic headaches are dependent on pelvic disease. As a rule, they occur when menstruation is delayed or when the flow is of short duration and it is presumed that a pelvic congestion exists. Here wool tampons soaked in glycerin are indicated; they cause a profuse watery discharge and thus relieve the congested vessels.

Leukorrhea may be of cervical or vaginal origin, and to determine its source, after cleaning out the vagina, place a tampon in the latter situation, adjusting it carefully to the cervix and vaginal vault. Keep the patient quiet a few hours and then remove the tampon. If the discharge is vaginal, the entire tampon is wet; if it is cervical, there is an accumulation in a little pool in the depression made by the cervix (method of Schultze).

TRANSILLUMINATION.

Sinuses of the Nose.—Various contrivances are sold for transillumination of the face. The electric light is held within the mouth with closed lips and the examination is made in a room absolutely dark. The best contrivance for this purpose should be easily sterilized and provided with a hood, as in the Coakley instrument, which prevents overheating (Fig. 104). According to Ohls, transillumination may be done by the employment of a cautery electrode protected by a small glass vial. If both sides of the face are equally brilliantly illuminated, particularly in the region of the lower eyelid, and a reddish light is seen in both pupils, the probabilities are that there is no pus in the antrum. When one side is more illuminated than the corresponding region of the other side, then in the non-illuminated or dimly illuminated region one of the following conditions exists: (1) A naturally augmented thickness of the antral wall; (2) an antral growth; (3) pus in the antrum. Both sides may be equally illuminated and yet a small quantity of pus may be present in one antrum. This error is likely to occur when the light employed is too intense. Both antra may transilluminate badly when the light is insufficient, the bones thick, or the nasal cavities obstructed. A failure to obtain proper illumination of the antra may also be due to the presence of an artificial denture. If, according to Kelly, an antrum which was previously dark transillumines after removal of its purulent contents as well as the healthy side, it is more likely to yield to treatment than if it remained dark. In illuminating the frontal sinus the lamp for transillumination is provided with a hood (*C*) (Fig. 104), which is pressed evenly and firmly against the skin to prevent the escape of light. The affected side shows a less illumined area than the healthy side in empyema of the sinus.

Symptomatology.—Antral empyema is characterized by a purulent discharge from one nasal cavity, which is more profuse in the morning, and pain confined to a definite region or implicating the entire half of the head. When the empyema is secondary to dental caries (bicuspid and molar teeth of the upper jaw), mastication is painful on the affected side. Antral infection occurs more frequently from the nose than from the teeth. When antral disease is suspected, cocain and adrenalin are applied to the nasal mucosa throughout the middle and inferior meatuses. Later, have the patient place himself across a chair with the top of the head on the floor, and in this position forcibly blow the nose. If the nose is again examined and antral secretion is present, the latter is forced over the lip of the hiatus beneath the *bulla ethmoidalis*. In empyema of the frontal sinus there is frontal headache over one eye, and over both eyes when both sinuses are involved. There may also be swelling of the upper eyelid and root of the nose. The pain is usually less during the day than the night, insomuch as the erect posture facilitates the escape of pus into the nasal cavity. Examination of the nose may show a few drops of pus in the region of the middle turbinate, which if removed and the patient forcibly blows his nose, pus will be seen again in the same location. Pressure above the inner canthus of the eye causes severe pain (avoid location of supraorbital nerve, which is naturally sensitive). Percussion of the affected sinus causes the occurrence of radiating pains. When the ethmoidal cells (ethmoiditis) are involved, there is post-nasal discharge, dull pain around the orbit, frontal, temporal, and occipital regions. Polypi are frequently present around the middle turbinate, and when they are removed, slight pressure with a probe reaches carious bone and pus may be revealed. Inflammation of the sphenoidal cells usually causes pain in the back of the head and the discharge of pus into the nasopharynx or nasal cavity. Pus may be discharged over the

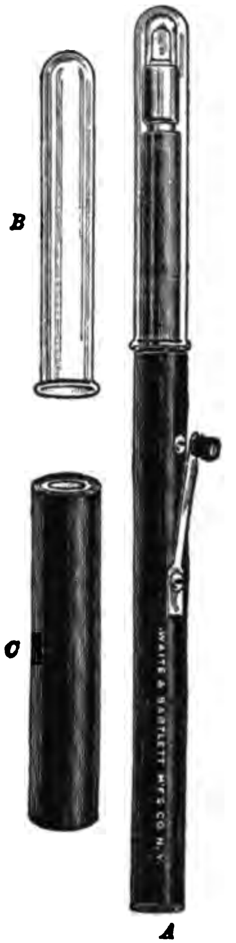


Fig. 104.—Coakley transilluminating set: *A*, Handle containing lamp and hood for transilluminating the antrum of Highmore; *B*, antrum hood detached; *C*, hood for use in transilluminating the frontal sinus.

anterior surface of the sphenoidal cell at the posterior extremity of the middle turbinal body. In all instances diagnosis is established by excluding suppuration of the other accessory sinuses.

Larynx.—With an ordinary laryngoscopic examination it is not easy to investigate at all thoroughly the parts of the larynx below the level of the vocal cords. It is also known that in tuberculosis and syphilis of the larynx the parts above the cord are those mainly affected, whereas in malignant disease there may be deep infiltration, burrowing, and forming a definite tumefaction on one or both sides of the subglottic region. In such cases Horne[383] has found of service a double lamp, such as that which is used for the transillumination of the frontal sinus. By placing it on either side of the thyroid cartilage one is enabled to obtain a better view of the subglottic region in a mirror placed in the mouth in the usual way, the investigation, of course, being conducted in a dark room. In this way one is able to form a better opinion, not only of the presence or absence of any disease in this region, but also, when present, of its extent.

Scrotum.—Serous effusions into the tunica vaginalis are usually translucent unless blood or fat is present in considerable quantity. In employing the light-test, the scrotal tissues must be stretched to make them as thin as possible. The room is darkened and a lighted candle or, better still, an electric light is placed on one side of the scrotum, and on the other side a rolled sheet of paper is used as a tube through which the dull red glow can be seen in effusions. A shadow indicates the position of the testicle. It is claimed that this reaction is obtained in small hernias in infants. Puncture assists in the diagnosis of scrotal tumors (page 618). Many *tumors* transmit light, whereas others do not. Thus the cysts, fibromata, lipomata, myomata, chondromata, and sarcomata may be transilluminated, whereas epithelial tumors are resistant to the penetration of light.

Stomach.—*Vide* gastrodiaphany (page 554).

Jackson[374] employs *gastroscopy*, which is the only method which yields ocular information as to the condition of the gastric mucosa. By this method he has successfully diagnosed malignant diseases and ulcers of the stomach. More than a third of the greater curvature and the fundus and pyloric ends of the stomach can be brought within range of the gastroscope. Any physician can learn to use the gastroscope.

If a small incandescent lamp be inserted in the auditory meatus, in a dark room, a healthy **mastoid** is immediately illuminated with a ruddy glow, whereas if the mastoid cells are occupied by a purulent collection, the glow will be absent and the cells dark. Comparison with the healthy side should always be made.

TUNING-FORK.

Hearing Power.—To determine whether defects in audition are dependent on nerve lesions or changes in the conducting apparatus the following tests are used: (1) The Weber test consists in first holding the handle of the tuning-fork (512 vibrations or lower) against the incisor teeth or on the median line of the skull. If the vibrating fork is best heard in the deaf ear, the lesion is located in the conducting apparatus, whereas the perceptive apparatus is involved if it is heard best in the better ear. (2) Rinné's test consists of holding a vibrating tuning-fork to the mastoid process until the sound is no longer perceived by the patient, then the fork (still vibrating) is quickly placed in front of the external ear. In the event that the conducting apparatus is not implicated, the tuning-fork is again heard, but if it is not heard, the transmitting apparatus is involved. A better auditory impression is obtained by air than by bone conduction, hence this test does not necessarily show an unaffected transmitting apparatus. (3) Politzer tests the permeability of the Eustachian tube by holding a vibrating tuning-fork (C″) in front of the nostrils during the act of swallowing. If the sound is then heard in one ear, the opposite Eustachian tube is probably closed. It may happen that the vibrations are better heard in the worse ear, if that happens to be the seat of a sclerotic otitis media with an open tube.

Malingerers who simulate total unilateral deafness may be detected if an A tuning-fork set in vibration is fixed vertically upon the middle of the skull; with one ear normal a tone is heard. If the patient declares that no tone is heard when the normal ear is closed, simulation is evident, for the normal ear would still hear the fork by bone conduction, though closed. Malingerers may declare that the vibrations of a fork (A or C) upon the skull in juxtaposition to the so-called deaf ear are not felt, whereas a tuning-fork of this type can be felt even by the deaf.

In **chronic appendicitis** anesthesia of the appendicular region is a frequent symptom, in my experience, and for its elicitation I employ the vibrations of a tuning-fork, using the corresponding side for purposes of comparison. The hyperesthesia often present is also easily elicited by the fork.

Bone Sensibility (Pallesthesia).—In the norm if a C (130 vibrations) or an A (440 vibrations) tuning-fork is placed upon the surface of a bone, a trembling or whizzing sensation is perceived. This sensation is diminished or lost (bone anesthesia) in the ataxic stage of tabes. Bone sensibility may be increased in incipient tabes and the vibrations of the fork produce a burning as well as a whizzing sensation. Bone sensibility is also altered in other affections of the nervous system. Thus, in hysteria the application of the fork is followed by the sudden disappearance of bone and cutaneous sensibility. Egger supposed that the vibrations of the fork were only perceived through the bones, but this theory was disproved by Goldscheider. The latter demonstrated after cocain skin-anesthesia that skin and bone participate in the perception of the vibrations.

The vibrating sensation in **diseases of the nervous system** is a delicate test for detecting even slight impairment of sensation, although the vibrating sensation may be lost when other forms of sensation are but slightly impaired, and occurs in early tabes, slight peripheral neuritis, and diabetes mellitus. Williamson[317] uses a tuning-fork 9 inches long, with prongs 5½ inches long. In diseases strictly limited in the motor structures the vibrating sensation is not lost, even at an advanced period of the disease. In any case in which the disease appears to be one causing lesion only of the motor parts of the nervous system, if it should be found that the vibrating sensation is lost, this fact indicates that the disease is affecting also sensory structures; and thus it may be of diagnostic value. In cases of paraplegia from spinal caries, and occasionally in spinal syphilis, the loss of the vibrating feeling may be the only objective symptom of altered sensation, at an early stage of the disease. In hemianesthesia, if the vibrating feeling is lost when the foot of the tuning-fork is placed on the edge of the sternum on the side of the tactile anesthesia, but felt on the other side, the case is one of hysterical or functional hemianesthesia, or of malingering; while in hemianesthesia due to organic disease the vibrating sensation is felt when the foot of the vibrating tuning-fork is placed on the edge of the sternum on the side of the tactile anesthesia (Fig. 105).

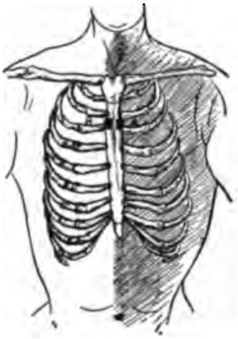


Fig. 105.—Tuning-fork test for hemianesthesia (*vide* page 672). Anesthetic side shaded. Test of Williamson.

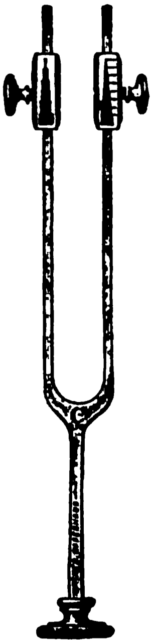


Fig. 106.—Tuning-fork for auscultation. With the hard-rubber attachment to the foot of the fork, the latter can be grasped by the teeth of the patient, making the use of a cork unnecessary. If the ends of the prongs are compressed by the fingers of the physician, sufficient vibration of the fork may be obtained without removing the latter from the mouth.

Auscultation.—Phonometry is a method of examination consisting in the application of a tuning-fork to determine the physical condition of the thoracic organs. When the handle of a tuning-fork after being struck is applied successively to the thigh, stomach, and thorax, the tone with reference to duration and intensity is different in all three situations. Over the stomach the greatest, and over the thigh the least, resonance is obtained; while over the lung the resonance is weak. In relaxation of the lung and over lung cavities the resonance is loud, whereas over consolidations it is weak. I employ the tuning-fork in connection with auscultation of the lungs. I use a fork with 120 vibrations, the end of which is inserted into a cork (Fig. 106) and grasped by the teeth of the patient, with closed lips. The fork can be made to vibrate by the fingers of the physician (the fork remaining in the patient's mouth). The auscultatory results are tantamount to those obtained by the whispering voice, but are more uniform and reliable. The situation of the bronchi may be located by the more intense vibration. It is possible that this method may prove of value in cranial auscultation, for in the norm the vibrations are uniform over the skull.

VACUUM-THERAPY.

Ear.—Evacuation of the tympanic cavity is of great importance in obtaining secretions for diagnostic purposes and as a curative measure in securing free drainage in acute otitis after paracentesis of the tympanum and preventing mastoid involvement. This treatment is free from the dangers of catheterization and Politzerization, which augment intratympanic pressure and may force septic matter into the mastoid cells. Fridenberg[233] practises suction through a sterilized glass tube, and by this means secures a dram or more of bloody or purulent fluid. The latter uses a small glass bulb about five-eighths of an inch wide, shaped like an olive with a very blunt tip. The neck of the glass bulb is stuffed with sterile cotton and attached to a short rubber tube, after both bulb and tube have been thoroughly boiled. Immediately after the paracentesis is made the glass bulb is pressed against the external meatus, plugging the canal hermetically. Suction is then applied and gradually increased until there is a flow of fluid from the middle ear and the glass bulb fills more or less. This suction can be made by using an ordinary piston syringe as an aspirator, or the lips of the operator may be applied directly to the rubber tube. The effects of this aspiration by energetic suction are strikingly gratifying. There seems to be less pain after the paracentesis than when an incision only is made. The otitic pain is more promptly and lastingly relieved. The paracentesis opening does not have as great a tendency to become closed, so that a second incision of the drum is less often required. Drainage is much more free.

Wood[293] employs as a middle-ear aspirator (Fig. 107) a glass tube three inches long with a reservoir for exudates. The aural extremity tapers and is tipped with rubber, and to the other is attached a syringe with a good sized chamber. When in place, the rubber-tipped end seals the opening, the piston is drawn out gently and retained until the reservoir fills or until no further exudates, blood, or serum escape. By this means these cavities are relieved of vast quantities of pathologic secretions which would never entirely drain away or be absorbed, but remain throughout life to threaten the integrity of the parts. While this procedure does not exactly sterilize these parts, by the removal of vast quantities of microorganisms their preponderance over the living tissues is destroyed. Another feature not to be ignored is the favorable influence exerted by the blood-letting principle applied by the instrument. It relieves congestion, soothes pain, and hastens convalescence.

Nose.—Sondermann[159] places an air-tight mask over the nose, to which a rubber bulb is connected, and thus produces a negative pressure in the nasal cavity to suck secretions from it and the accessory sinuses. To shut off the oropharynx the patient says "ee" or inspires through pointed lips. Spiess[160] attains the same object with a suction-pump operated by an electric motor. Both authors commend this method in diagnosis and treatment. Thus, in ozena and in suppurative rhinitis of children the removal of more secretion than could come from the nasal cavity alone directed attention to implication of the sinuses.

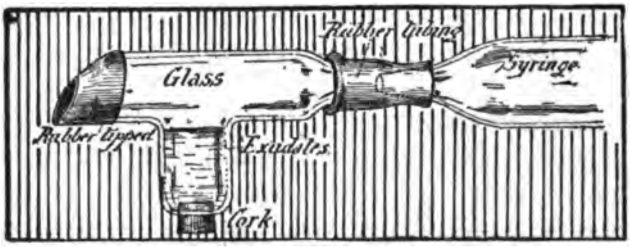


Fig. 107.—Middle-ear aspirator.

Tonsils.—Prym reports favorable results in the treatment of tonsillar angina by means of suction-tubes of such shapes and dimensions as to adapt themselves to different sized tonsils. The air is exhausted by a rubber bulb and is not painful. Even after a single application deglutition was possible even though dysphagia was present. It is evident that the same method would be applicable in the diagnosis of deep-seated suppurations of the tonsils and to note whether the tonsillar crypts are occupied by cheesy material, which is frequently the cause of ozostomia (foul breath), and also for obtaining material from the crypts for microscopic examination.

Tumors.—Ritter[161] employs suction-cups for aspirating material from tumors and fistulas for microscopic examination without danger of hemorrhage or of accelerating the growth of the tumor. In one case described, a dubious tumor in the upper abdomen showed fluctuation. A puncture opening was made with a wide cannula, and a cupping glass, such as Bier uses for the breast, was applied daily. In a few days the edema had subsided and the tumor could then be palpated. Jelly-like masses were aspirated by the suction, and the patient was much relieved and gained five pounds in weight in seven weeks. The opening was enlarged by a small incision and scraps were obtained for microscopic examination by means of forceps introduced into the tumor through this opening. Ritter has applied this suction-therapy in a number of other cases, mostly inoperable cancers. It always brought great relief, while no untoward effects were observed in any instance. In the exceptional cases requiring unusual diagnostic measures the suction-cup will be found very useful.

Weinbrenner[353] employs suction treatment in **gynecology.** He uses a large cylinder with a flaring top as a cupping-glass to introduce into the vagina and induce suction hyperemia of the lower segment of the uterus. He mentions a number of contraindications for the use of this method of treatment, but states that it has proved extremely valuable, in his experience, in cases of chronic changes in the pelvic cellular tissue and chronic affections, especially catarrhal, of the uterus. A healthy uterus is not affected injuriously by the suction, while the diseased uterus is relieved of pus and mucus, which are aspirated by the suction, while the circulation is stimulated and some blood is drawn, as by venesection. The suction and consequent drawing down of the uterus stretch the adhesions and circulation generally in the region is improved. The suction is unpleasant at first, causing pain in the sides and sacral region resembling a labor pain, but this soon passes away, and in many instances the patients are permanently free from pain afterward. Weinbrenner applies the treatment for about twenty minutes, arresting it and allowing the air to enter the glass three times for a minute each in the course of the sitting. Women who had been treated by other measures for a long time previously, without benefit, state that they feel better than for years; they can walk freely and easily without the old discomfort from adhesions. He repeats this "suction-massage," as he calls it, when pain returns, sometimes after a week, sometimes earlier. Some patients required several sittings before they were permanently relieved, and in a few instances the insertion of a pessary was necessary to complete the cure—the pessary before not being tolerated. No injurious effect on rectum or bladder was ever discovered.

The writer has noted that when a cupping-glass is applied to the palm of the hand or elsewhere and strong suction employed, **capillary hemorrhages** may ensue, and the latter may be recognized with a lens. Such hemorrhages are more frequent in arteriosclerotics with brittle vessels.

During *lactation*, the retention of milk may cause indurated inflammatory infiltration of the breast (milk abscess). The use of a breast-pump causes its disappearance.

VIBRATORY MASSAGE (SISMOTHERAPY).

In medical literature I have repeatedly referred to certain visceral reflexes evoked by cutaneous irritation. The reflexes in question are endowed with more than mere physiologic interest. They yield unequivocal demonstration of the fact that the sensory peripheral nerve terminations receive impressions which are conducted, communicated, or reflected by aid of the nervous system. Such impressions react on the viscera, and the manifestations of the reaction may be utilized in a diagnostic and therapeutic direction. The evidence heretofore adduced in explanation of the results achieved by electric, hydriatic, mechanical, and the balneary treatment of disease was naught else than a mere array of words conceived in conjecture only. Others less inclined to hypothesize sought an expeditious solution of the subject by referring their action to suggestion. The investigations of Head show that in visceral disease pain and disturbed sensation may be referred to definite cutaneous areas. Clinicians have given due regard to such cutaneous expression of visceral disease, which, if I may be permitted so to call it, is practically an endogenetic skin reflex, but they have disregarded the exogenetic skin reflexes. I have described the concussional *vertebral reflexes*,[163] an entirely new domain, and one may be very readily convinced that the manipulation of the vertebræ by the osteopath and the effects on the patient are not wholly a question of suggestion; on the contrary, the osteopath unknowingly elicits many visceral reflexes which may operate for good or evil. Concussion of the vertebral spinous processes, whether by manual manipulation or by vibratory massage, will induce palpable lung, heart, liver, spleen, stomach, and intestinal reflexes, depending on the vertebræ subjected to concussion. Vibratory massage employed in the conventional way by a thorough disregard of localization can effect results by suggestion only; and again, as in the *aortic reflexes*, by striking certain vertebræ one elicits results contrary to expectation. To obtain visceral effects from vertebral concussion, the author must emphasize the importance of employing a vibratory apparatus which gives a percussion stroke, vibration alone yielding no results. Any one who has reason to doubt the value of manual manipulation of the spine may attempt a maneuver which I have observed recently. While palpating, say, the radial pulse, make firm pressure at the vertebral exit of the spinal nerves (preferably at the side of the upper dorsal vertebræ), and one will note a decided alteration in the character of the pulse, which amounts to inhibition of the latter if the pressure is firm enough and sufficiently long continued.

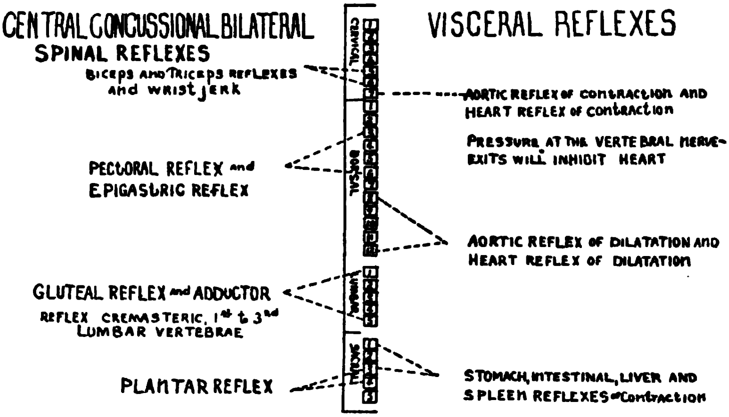

CENTRAL CONCUSSIONAL BILATERAL SPINAL REFLEXES
BICEPS AND TRICEPS REFLEXES AND WRIST JERK
PECTORAL REFLEX and EPIGASTRIC REFLEX
GLUTEAL REFLEX and ADDUCTOR REFLEX CREMASTERIC, 1st to 3rd LUMBAR VERTEBRAE
PLANTAR REFLEX
CERVICAL
DORSAL
LUMBAR
SACRAL
VISCERAL REFLEXES
AORTIC REFLEX of CONTRACTION AND HEART REFLEX of CONTRACTION
PRESSURE AT THE VERTEBRAL NERVE-EXITS WILL INHIBIT HEART
AORTIC REFLEX of DILATATION AND HEART REFLEX OF DILATATION
STOMACH, INTESTINAL, LIVER AND SPLEEN REFLEXES of Contraction

Fig. 108.—Vertebral concussional reflexes, showing the vertebræ to be concussed for their elicitation.

Reference to the illustration (Fig. 108) shows the reflexes thus far elicited by the writer as a result of vertebral concussion. The anatomic *landmarks of the spine* are easy of recognition. At the bottom of the furrow or median groove in the back lie the spinous processes. Palpation of the spines is facilitated by directing the patient to double over to the front, or the spines may be rubbed with the hand, thus evoking a spot of hyperemic redness over the tip of each spinous process. The seventh cervical vertebra is easily recognized owing to its prominence, and serves as a guide to count downward. When the patient is sitting with the arms hanging at the side, the inner end of the spine of the scapula is on a level with the third dorsal spine, and the inferior angle of the scapula corresponds to the seventh dorsal spine. The spine of the last dorsal is on a level with the head of the last rib. The highest part of the ilium is at about the level of the fourth lumbar spine. The relationship of the root origin of the spinal nerves to the spinal vertebræ may be determined as follows:

From the upper four cervical nerves subtract 1 from the number of the nerve; thus, the root origin of the third cervical is opposite the second spine.

Lower four cervical and upper six dorsal subtract 2; hence, the origin of the eighth cervical is opposite the sixth cervical spine.

Lower six dorsal subtract 3 from the number of the nerve; thus, the ninth dorsal corresponds to the sixth dorsal spine.

The lumbar nerves arise in the region of the tenth and eleventh dorsal spines and the sacral nerves between the eleventh dorsal and first lumbar spines.

Space forbids a discussion of the practical value of the vertebral reflexes in diagnosis and treatment, and the reader is referred to my original article.[162] Here reference will be made briefly to the symptoms emanating from *heart dilatation* and *thoracic aneurism.* Vibratory massage of the seventh cervical vertebra, by inducing the heart and aortic reflexes of contraction, should ameliorate the symptoms of heart dilatation and aneurism respectively, whereas massage of the five lower dorsal vertebræ will intensify the symptoms. I have thus far treated five cases of aortic aneurism by means of vibratory massage of the seventh cervical vertebra. Three cases were apparently cured, one case (advanced) uninfluenced, and one case escaped further observation. Even after the first treatment (séance fifteen minutes) improvement was noted.

Reference is made elsewhere (page 374) to the heart reflex theory of angina pectoris. By inducing the heart reflex the pains of the latter affection may be provoked, and this may be possible by concussion of the seventh cervical vertebra, which excites the heart reflex. This sign may prove of some value in the diagnosis of stenocardia. By fixing a pleximeter in the precordial region and striking it a series of vigorous blows with a percussion-hammer, the pains of *angina pectoris* may be reproduced. This is an early sign of the affection, and I have frequently employed it in suspected cases. I have unintentionally provoked anginal attacks lasting several hours by the application to the heart region of the sinusoidal current (*q. v.*).

For further facts concerning the aortic reflexes *vide* page 633.

Kelly employs the following method of bimanual **vibratory palpation** for accurately outlining kidney or pelvic tumors: In the case of a pelvic tumor, the finger in the vagina rests lightly on the cervix if it is uterine, or on its lower pole if ovarian. The other hand plays lightly over the abdominal wall, over the tumor, touching first its central portions and then advancing toward its periphery in all directions, communicating a series of rapid, light, vertical succussion-movements.

CHAPTER V.

ETIOLOGIC-DIAGNOSTIC-THERAPEUTICS.*

Previous Diseases: Alcoholism to Typhoid Fever.—Diatheses: Apoplectic Habitus to Status Lymphaticus.—Special Periods: Childhood, Puberty, Menstruation, Menopause, Marriage, Pregnancy, Puerperium, Lactation, Senility.

The primary effort in therapeutics is to annul the conditions which produced the disease. The personal history of the patient suggests a multitude of facts available in diagnosis. We will succinctly study in sequence: (1) *Previous diseases* (congenital and acquired). (2) *Diatheses.* (3) *Conditions prevailing at special periods.*

PREVIOUS DISEASES.

Alcoholism (*vide* page 46).—W. Bevan Lewis[163] shows that parental alcoholism tends to the evolution in the progeny of degenerate and explosive types of criminality, psychosis, and neurosis, *e. g.*, idiocy, imbecility, moral and impulsive psychoses, adolescent insanity, hysteria, chorea, and epilepsy.

Paternal alcoholism is more often followed by the explosive and motor types, *e. g.*, epilepsy; whereas maternal alcoholism is more apt to give rise to the developmental arrests, *e. g.*, idiocy and imbecility. The physician is often constrained to depend on certain objective signs in the recognition of the chronic alcoholic. There are sensory (hyperesthesia, paresthesia, or anesthesia) and motor (tremor) disturbances of peripheral nervous function.

Quinquaud's sign is said to be present in most chronic alcoholics, and is elicited as follows: The patient presses steadily downward with partially flexed and partially separated index, middle, and ring fingers of the hand in the prone position upon the supine and fully extended palm of the examiner; in a few seconds a sensation of crackling or crepitus is conveyed to the palm of the examiner from the fingers of the subject. Minor[325] has recently investigated this sign in a large number of persons, and modifies the method of its detection by having the patient place his fingers in contact with the diaphragm of a phonendoscope, thus converting the sign into an auditory phenomenon. He concludes that the crepitations are not pathognomonic of alcoholism, and are even found in total abstainers, notably in tabes and hysteria. The sign in question is characteristic of hypotonicity and is regarded as a very delicate test for neuromuscular fatigue.

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* Consult Diagnosis, Chapter I, for further facts concerning this subject.

In mild *alcoholic delirium* without apparent hallucinations Reichardt[164] hands the subject a blank sheet of white paper and instructs him to describe what he observes. The subject describes all sorts of things, and this test for eliciting visual hallucinations is regarded as pathognomonic of alcoholic delirium. Slight mental impairment in alcoholics, as well as in others, may be detected by Marie's test; the patient is given three pieces of paper of unequal size and is told to do something with each piece; the patient will be able to execute each order when given separately, but will become confused if the three orders are given at one time. Marie's test is also used in *aphasia*, which in every case is characterized by a deficient comprehension for spoken language, and there is always a diminution of intellectual capacity, which is betrayed by the test. Thus he says: "On the table are three pieces of paper; give me the largest piece, crumple up the middle-sized piece and throw it on the floor, and put the smallest piece in your pocket."

Williamson[308] regards the loss of the *tendo Achillis reflex* as an aid in the diagnosis of alcoholic failure of the heart, and it is one of the first signs of the injurious action of alcoholic beverages on the peripheral nervous system, and that this reflex is often lost long before the knee-jerk. The tendo Achillis reflex is not present in non-alcoholic cardiac disease unless there is some nervous complication, like tabes.

Anstie's Rule for Alcoholics.—The maximum amount of absolute alcohol which can be taken by an adult without injury is one and a half ounces daily. This is equivalent to about three ounces of whisky, brandy, gin, or rum, about four wineglassfuls of sherry, or other strong wine, to one pint of claret, champagne, or other light wine, to three glasses of strong ale or porter, or five glasses of beer or light ale.

Caffein Beverages.—These must not be ignored among the etiologic factors. Tea, owing to its tannin, interferes with digestion by precipitating proteids and albumoses and irritating the gastric mucosa. Coffee contains the empyreumatic oil, caffeol, formed in the roasting of coffee, which is an irritant and causes digestive disturbances. The persistent use of these beverages causes tremors, nervousness, and palpitation, and chronic melancholia is regarded as a frequent symptom by Sollmann.

Appendicitis (*vide* page 124).—Attention has already been directed to the possibility of misinterpreting appendicular for dyspeptic symptoms. Longuet has given the name "*dyspepsie appendiculaire*" to the gastric symptoms secondary to appendicitis. The dyspeptic symptoms usually occur in from three to five hours after a repast, and they often end in vomiting. The subjects usually manifest, according to Walther, an intolerance for certain aliments, such as red wine, fats, sauces, eggs, and milk. An almost constant phenomenon is the augmentation of appendicular pain after fatigue. Bryon Robinson has shown that the appendix is frequently in contact with the psoas muscle in men, and may therefore be bruised by the action of this muscle. With the patient in the recumbent posture, sudden extension and flexion of the thigh on the trunk will often elicit severe pain.

In acute appendicitis the diagnosis is rarely difficult when localized pain in the right iliac fossa (McBurney's point), gastro-intestinal disturbances, fever, and a furred tongue are present. While the tenderness is usually most pronounced at the McBurney point, which is said to indicate the point of origin of the appendix, it is often a little lower down, at Clado's point (where the line from one anterior superior iliac spine to the other crosses the outer edge of the right rectus). Sherren has shown that the tenderness is encountered over any part of the area innervated by the eleventh dorsal nerve, and that it may be provoked by gently pinching up the skin, provided the appendix is not perforated, after which occurrence this phenomenon is usually absent. Hyperalgesia of the skin is also present in hysterical appendicitis, but is not as deep-seated as in genuine appendicitis. The danger of an erroneous diagnosis arises in chronic appendicitis. In the latter affection paroxysms not unlike ordinary colic may persist for years at irregular intervals.

Previous attacks occur, according to Hawkins, in 23 per cent., and according to Pepper, in 44 per cent. of the cases. Lockwood makes the pertinent observation: "To say that a man with appendicitis has been cured by medical means is, in many cases, equivalent to saying that a man with a stone in his bladder has recovered from calculus after the cure of a cystitis by rest in bed." Exploration of the right iliac fossa may detect a thickened appendix, and pressure, if it does not cause pain, will at least cause some discomfort. Pressure-pain is most marked at the McBurney point, which corresponds to the root of the appendix (2 inches to the inner side of the anterior superior spinous process on the right side, along a straight line drawn from the process to the navel). If this or any other localized point of tenderness should persist (in the absence of any other cause) despite the disappearance of dyspeptic symptoms and constipation, after a careful regimen, it is most likely that the appendix is involved. Rigidity and the presence of a tumor in the right iliac region fortify the diagnosis. After palpation of a diseased appendix, the pain persists for several hours, and at times the pressure may provoke nausea and even vomiting. Attention has been called to hyperesthesia of the skin in the appendicular region after pinching and diminished sensibility when it is pricked. By lifting the hand suddenly after palpation, pain of appendicular origin is very much accentuated. The "*triade douleureuse*" which Dieulafoy regards as characteristic of acute appendicitis consists of cutaneous hyperalgesia, reflex muscular rigidity (*defense musculaire*), and tenderness on pressure.

If the appendix is enlarged and tender, the method of palpation suggested by Robert T. Morris may be useful. The surgeon stands to the right of the patient and uses three fingers of the right hand to feel with and three fingers of the left hand to press with. No muscular effort must be used by the hand which feels. The feeling fingers are pressed by the other fingers beneath the margin of the right rectus muscle on a level with the navel, and are drawn toward the patient's right side, when the colon will be felt to roll under the fingers. The process is repeated several times until the end of the cecum is reached. By rolling the latter from side to side with the finger-tips and working toward the proximal end of the appendix, the latter is sought for. The appendix is said to have been absent five times in 10,000 autopsies.

One must never neglect to examine the appendix per rectum. The investigations of Cazin and Gros[165] show that leukocytosis may be present even in the absence of suppuration, and Sherren[166] has shown that cutaneous hyperalgesia may persist in the intervals of the attacks, owing to tension within the appendix kept up by the presence of a stricture. It is known that in appendicitis the paralysis of the bowel may be so pronounced as to simulate obstruction of the bowel, and I have noted, even in the intervals of the attacks, a persistence of this paralytic condition, usually limited to the region of the appendix. Scratching of the abdominal skin in the region of the appendix will not induce the *intestinal reflex*, as evidenced in the norm by augmented tympanitic resonance. I have also observed that in the norm there is a respiratory dislocation of the tympanitic area, *i. e.*, on deep inspiration percussion

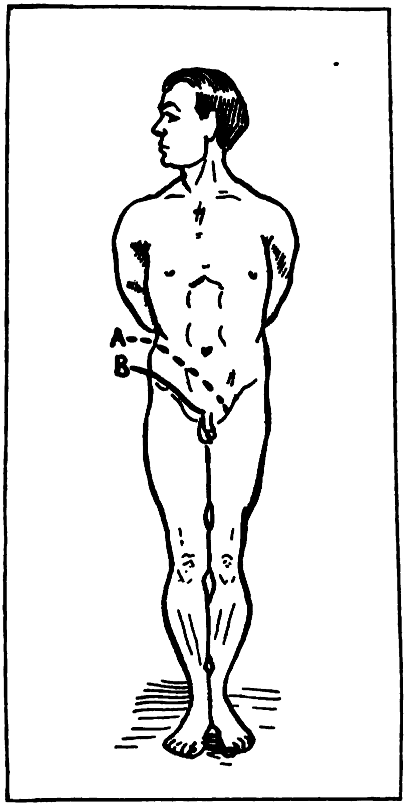

Fig. 109.—Respiratory dislocation of the tympanitic area in the right iliac region. *A*, Lower border of tympany at the end of expiration; *B*, lower border of tympany at the end of forced inspiration on percussion. In the norm this respiratory dislocation between forced inspiration and expiration is from 5 to 8 cm. in the recumbent posture. In appendicitis, this respiratory dislocation is inhibited or absent, due to abdominal rigidity, pain, or peritoneal adhesions.

will show an extension of the percussion sound even as far as the inguinal fold, but which recedes during expiration (Fig. 109). In the appendicular region in acute or chronic appendicitis, this respiratory dislocation of tympanitic resonance is either absent or very much restricted, and is no doubt due to the presence of adhesions.

Kahn observes that bradycardia in the course of an appendicitis signifies latent gangrene, and calls for an immediate operation. He does not deny, however, that tachycardia may be associated with the same condition. Broca[362] has studied this observation of Kahn, and concludes that little value can be attached to the observation in question, insomuch as many anomalies of the pulse are noted in appendicitis and other intestinal affections, due essentially to reflex rather than infectious causes. He suggests the use of morphin as a means of diagnosis. After the use of the latter, if the previously slow pulse becomes more rapid, it suggests a reflex origin.

I have frequently noted that when a purgative has been given in a suspected case of appendicitis, the patient can locate the sensitive area of the appendix, and the physician will find the region thus located especially sensitive to pressure. Thus a purgative may be employed for the diagnostic purpose in question. Similarly, other sensitive areas may be defined, the purgative stretching adhesions and accentuating congestion. If obscure abdominal pains are reproduced by a purgative, they are probably enterogenic.

Appendicular Colic.—In this condition digestive disorders are associated with colicky pain in the right iliac fossa or umbilicus, and temporary tenderness, nausea, and constipation may be present.

Diphtheria.—Certain facts must be recalled in the etiology of this disease. Contagion from person to person is frequent, or contact with articles used by an infected individual. Thus the bacilli have preserved their virulence on a child's plaything which had been kept in a dark place for five months. A case is reported by Golay in which bacilli were demonstrable in the throat for three hundred and sixty-two days. Age is an important etiologic factor, the majority of cases occurring between the ages of two and fifteen years. Defective hygienic mouth-conditions and nasal catarrh are predisposing causes.

Thomas investigated diphtheria in connection with London schools, and found that 16 per cent. could be definitely traced to school influence. Among the sequelæ of the disease are: nephritis, paralysis (in 10 to 20 per cent. of the cases occurring usually in the second or third week of convalescence), heart-symptoms (irregularity, dilatation, and weakness), and neuritis. Among the local paralyses the most frequent is that affecting the palate, which is relaxed, motionless, and shows diminished sensibility. The voice has a nasal character and fluid may be returned through the nose in the act of swallowing. The intrinsic and extrinsic ocular muscles may be involved, and then there may be ptosis, disturbances of the power of accommodation, and strabismus. The multiple form of neuritis may involve the muscles of the extremities or the muscles of respiration. The tendon reflexes may be lost without other symptoms of neuritis.

Gastro-intestinal Diseases.—Many cases of *chronic dyspepsia* are secondary to constitutional conditions, such as anemia, tuberculosis, diabetes, gout, and Bright's disease; whereas local conditions may be masked by the prevailing symptoms of dyspepsia, *e. g.*, ulcer, cancer, or dilatation of the organ, and chronic affections of the liver and heart. William Macewan makes the following pertinent observation: "The appendix is the most frequent, but least recognized, cause of chronic dyspepsia." When the appendix is the site of chronic inflammation, the symptoms of indigestion are intensified with each recurrent attack. Cholelithiasis is another condition which is frequently misinterpreted as chronic dyspepsia. Recently a number of cases of *acute dilatation* of the stomach have been reported following injury or an operation. There is a sudden paralytic distention of the organ, characterized by vomiting of large quantities of fluid and collapse. The prognosis is bad. In several instances after laparotomy the dilatation was evidently caused by acute obstruction, which in turn was provoked by a kinking of the duodenum. Another sequel of abdominal operations is intestinal obstruction (*post-operative ileus*). Paralysis of intestinal peristalsis is usually secondary to even trivial abdominal operations and generally yields to the conventional treatment. The acute forms are characterized by early symptoms occurring within thirty-six hours, and consist of the signs of obstruction, viz., persistent vomiting, pain, and abdominal distention. Among the etiologic factors are kinking of the intestines, thrombosis of the intestinal vessels, and adhesions. In the acute forms the prognosis is always grave, and if atropin (page 299) is not effective in physiologic doses, early surgical intervention is imperative. In post-operative ileus the symptoms may often be arrested at once by turning the patient on the stomach, the occlusion in such instances being due to traction on the mesentery of the small intestine. The prone posture has also been suggested with good results in post-operative dilatation of the stomach. Chronic dilatation of the organ is often caused by an excessive ingestion of food and fluids. *Gastric ulcer* is commonly associated with anemia and chlorosis in young females who suffer from dyspeptic symptoms; the latter, in fact, may be mere manifestations of the ulcer. There are two sequelæ which are exceedingly troublesome, viz., perigastric adhesions and cicatrization. *Perigastric adhesions* frequently occur, according to autopsy records (5 per cent.). They are characterized by local tenderness influenced by position, and relieved by pressure. *Cicatrization* of an ulcer situated near the pylorus may lead to a stenosis of that orifice, and in other instances, the annular ulcer may cause an *hour-glass contraction* of the stomach. Moynihan refers to the following symptoms characteristic of the latter: (1) Part of the fluid is lost in washing out the stomach. (2) If the stomach is apparently emptied, a sudden reappearance of the stomach-contents may occur. (3) When the stomach has been apparently emptied, a splashing sound may be elicited by palpation of the pyloric segment (paradoxic dilatation). (4) After distending the stomach, a change in the position of the distention tumor may be seen in some instances. (5) Two tumors with a sulcus between may be apparent to sight or touch. *Cancer of the stomach* in three-fourths of the cases occurred between the ages of forty and seventy years (Welch). In only 11 out of 150 cases was there a positive family history of cancer. Very few patients complain of a previous history of dyspepsia, and this fact, taken in connection with the occurrence of dyspeptic symptoms without apparent cause and progressive loss of weight, strength, and anemic symptoms, in a person advanced in years is strongly suggestive of cancer. The test should be made for occult hemorrhages (page 448), which are frequent. In *hematemesis* one must be sure that the colored vomit is really blood, as determined by chemic tests and microscopic examination. Various articles of food (wine, strawberries, cranberries, raspberries) may give the appearance of blood to the vomit. Similarly iron, bismuth, or bile may yield the appearance of altered blood. Then the mouth, nose, and throat must be examined for the source of bleeding and to exclude deception in hysterical subjects. Next one determines whether the blood has been coughed up or brought up by vomiting. Blood from the stomach is usually clotted, mixed with particles of food, and acid in reaction, whereas in *hemoptysis* it is frothy, bright red, and alkaline in reaction. In *neuroses of the stomach* we must look for the stigmata of the neurotic constitution.

Diarrhea (*vide* page 129).—Foster described 101 different diarrheas. *Simple diarrhea* is often a question of habit occurring in large eaters and drinkers. The stools contain no undigested food and nutrition is uninfluenced. *Lienteric diarrhea*, on the contrary, shows undigested food in the stools, and is caused by digestive disturbances, by faulty mastication, or by the excessive ingestion of food. In *toxic diarrhea* dependent on the ingestion of decayed or poisonous substances the diarrhea is sudden, profuse, and painful, and accompanied by nausea and vomiting. Diarrhea of intestinal origin is frequently caused by stimulation or irritation of the enteric mucosa by food-products which are resistant to digestion or by the presence of abnormal products the result of fermentation. When increased peristalsis is limited to the large intestine, nutrition may not be affected, whereas its limitation to the small intestines causes malnutrition, because absorption is prevented. The effects of diarrhea on the organism are dependent on conditions which evoke augmented peristalsis. *Nervous diarrheas* occur in individuals with the stigmata of the neurotic constitution. Emotional disturbances are important etiologic factors. Hysterical girls often suffer from augmented peristalsis and gurgling sounds are heard, but diarrhea is not necessarily an accompaniment. These diarrheas are also associated with organic disease of the nervous system, and the intestinal crises of tabes may be cited by way of illustration. In nervous diarrheas the watery character of the feces suggests that there is usually a hypersecretion from the enteric mucosa. When this hypersecretion involves the large intestines, the excessive mucous secretion forms casts, which are discharged paroxysmally, associated with colicky pains of great severity (*mucous colitis*). Emotional disturbances or errors in diet may bring on an attack. The so-called *morning diarrhea,* in which two or three stools are passed at short intervals, is usually present in neurasthenics. Diarrhea also occurs as a symptom in general diseases, viz., infectious diseases (particularly measles) and Bright's disease. A *diarrhea from irritation* occurs in fissure of the anus, from accumulation of feces, or from other sources of local irritation. When a diarrhea alternates with constipation, one must always think of fecal impaction.

Intestinal ulceration is usually accompanied by diarrhea. Tuttle refers to a "nagging diarrhea" with increased desire to go to stool, without satisfactory results, and the occasional passage of a little mucus, as one of the earliest symptoms of intestinal carcinoma.

Intestinal sand passed with the stools is false when it is made up of food-remnants (vegetables and fruit) which have been covered with earthy salts, and true when it is of animal origin and composed mainly of lime salts. This sand is frequently discharged in mucous colitis.

Gonorrhea.—This, with the exception of measles, is said to be the most widespread of all contagious diseases.

This affection and its sequelæ are important etiologic factors in pathology. The serious complications of the primary lesion result from the extension of the process by direct continuity of tissue; thus, in the female the peritoneum and uterus and adnexa are involved, whereas in both sexes, the bladder and kidneys. Sterility is observed, according to various reports, in about 42 per cent. of all persons affected, and Price claims that 95 per cent. of abdominal operations in women are the result of gonorrheal infection. The gonococci may remain quiescent for years without losing their virulence. Thus, Wilson reports a case where an individual infected his own eye six years after he considered himself cured. In systemic gonorrheal infection the heart, joints, and periarticular tissues are involved and gonococci may be demonstrated at the site of the lesion. Cerebrospinal meningitis has been observed, and in the fluid from the lumbar puncture gonococci have been demonstrated. In some instances there is mixed infection. The cardiac lesions are usually limited to the endocardium, although the pericardium and myocardium may also be implicated in the metastatic infection. Gonorrheal arthritis has been shown by Lucas to have occurred eighteen times in twenty-three cases of children suffering from ophthalmia neonatorum. The joint complications may occur during the time of an acute, subacute, or chronic discharge. Joints are usually involved (sternoclavicular, temporomaxillary, intervertebral, sacroiliac) which ordinarily escape in acute rheumatism. The following varieties of gonorrheal arthritis are usually observed:

1. Periarticular, when the inflammation implicates the sheaths of the tendons and may or may not be followed by suppuration. The bursæ and periosteum may also be involved.
2. The lesion may be a periostitis of the os calcis, as in the so-called "painful heel" of gonorrhea.
3. There may be no evidence of inflammation in or around the joint, yet the patient may suffer from pains (arthralgia).
4. A polyarticular variety, in which a number of joints are affected and in which visceral complications and septicemia are present.
5. A monarticular form. Here the pyrexia is out of all proportion to the minor joint-symptoms.
6. Chronic hydrarthrosis, which is usually monarticular and is unaccompanied by inflammatory symptoms.

Gonorrheal exostosis of the os calcis has recently been described. The chief symptoms are pain, with thickening of the periosteum on both sides of the os calcis, and the patient walks on the ball of the foot. It is usually bilateral and occurs at any time (usually three to ten months) after an attack of gonorrhea.

Maternal gonorrhea is supposed to exert no unfavorable influence on the offspring beyond a possible ophthalmia. Investigations made by Lobenstine and Harrar[394] show very conclusively that the general nutrition of the infant is likely to fail. Gonorrhea in the mother is a frequent cause of premature births, and in the series of cases reported it was estimated to be about 22 per cent., whereas under normal conditions it occurs only in about 2 per cent. of the cases.

Influenza.—Practically every disease in our nosology has been referred to an attack of influenza. Now that the bacteriology of this disease is known ever since the discovery of the influenza bacillus, the nature of a sequela can in many instances be definitely determined by the demonstration of the bacillus. Thus, in cholelithiasis following an attack, the influenza bacilli were demonstrated in the pus of the gall-bladder. In influenzal epidemics of recent years the influenza bacillus has not been found, but, instead, the pneumococci of Fränkel, even in the absence of bronchitis and pneumonia. Influenza is characterized by the fact that extreme prostration, out of all proportion to the general symptoms, is associated with the disease, and persists for an indefinite period after apparent recovery.

Measles.—Among the more frequent sequelæ of this affection are: Bright's disease, hemiplegia, paraplegia, keratitis, otitis media, polyneuritis, arthritis, pertussis, and more rarely multiple sclerosis.

Pertussis.—Among the complications and sequelæ are hemorrhages, pulmonary affections, heart-strain, and enlargement of the bronchial glands. The latter are no doubt identified with tuberculosis and paroxysms of asthma which follow an attack of pertussis. These enlarged glands have even been identified with the etiology of the disease itself.

Pneumonia.—A history of a previous attack of this disease is of importance in etiology, for there is no other acute disease in which recurrence is so common. After recovery from pneumonia it is a mistake to pronounce the patient well until a thorough physical examination has been made (*vide* page 512). The complications and sequelæ consist of pneumococcus infection of organs and tissues other than the lungs. Among the sequelæ are: metapneumonic empyema, which is more common in children than adults, abscess of the lung, pericarditis (found in 10 per cent. of all autopsies), endocarditis, pneumo-arthritis, meningitis, and nephritis. Meningitis arises most frequently during the stage of gray hepatization. The inflammation is usually purulent. The albuminuria of pneumonia, like many other infections, is of pyrexial genesis and not dependent on nephritis. The latter can only be said to exist when albuminuria (with casts in the urine) persists after recovery from pneumonia, and the associated signs of nephritis are present.

Scarlet Fever.—Nephritis may follow a mild attack. It complicates 10 to 20 per cent. of the cases. Usually occurring in the second or third week, it may be delayed to the fourth week. Occurring early in the disease, it is of more serious prognostic import than when occurring later. Arthritis may be accompanied by suppuration of several joints due to streptococcus infection, and is usually fatal, or as a milder form, occurring in the second or third week and attacking a number of joints, notably those of the hand. Cardiac complications are often latent and any or all of the cardiac structures may be involved. Ear complications contribute most frequently to the deafness in children. The ear is usually invaded by an extension of the throat inflammation through the Eustachian tubes. The glands of the neck are practically always involved in even mild cases, but the adenitis may persist. Among the nervous complications are chorea and hemiplegia. If fever persists after disappearance of the exanthema, a condition known as scarlatinal-typhoid, it is usually dependent on some suppurative process resident in the throat, nose, or glands of the neck.

Syphilis.—The eminent syphilologist, Jonathan Hutchinson, assures us that this disease is on the decline, yet other authorities argue differently. It is stated that there are 50,000 cases of fresh syphilitic infection per annum in the city of New York. It is thus evident that the human race is rapidly becoming not only civilized but syphilized. At the present time of writing, while considerable proof has been adduced that the spirochæta pallida is the germ of syphilis, it is yet insufficient. This germ is difficult to differentiate from other spiral bodies; it does not occur alone nor is it present in great numbers in the lesions. Neisser claims that material capable of producing syphilis in apes has been found free from spirochætæ. Some claim to have found the spirochæta in small numbers in tertiary syphilis, which would make the disease contagious in every stage. More recently, White[321] has found the spirochetes in the lymph-glands in Hodgkin's disease, and he conservatively concludes either that the organisms in question are the cause of Hodgkin's disease or that the latter is a mild form of lues. In parasyphilitic affections the specific virus appears to have a special neurotoxic action. Thus Babinski reports the cases of two students who were infected the same day by the same woman, and fifteen years later both died of general paralysis. Erb cites the history of four patients infected by the same woman who later became the subjects of either tabes or general paralysis. Thus it is that familial tabes seems to demonstrate the existence of a neurotoxic virus.

Hereditary Syphilis.—Reference has already been made (page 190) to the symptoms of hereditary syphilis. Jonkowski[167] directs attention to the dryness and mobility of the skin in syphilitic infants, most pronounced on the chest and abdomen. Comby[168] refers to enlargement of the cervical glands which simulate tuberculous adenitis. The rapid disappearance of the swelling under mercurial inunctions suggests its luetic origin. Joint affections are not uncommon. Wilson[169] refers to the early hemorrhages (syphilis hæmorrhagica neonatorum) and the commoner symptoms of hereditary syphilis. Marasmus begins within a few days after birth, snuffles within the first six weeks, skin eruptions within the first three months, and an enlarged spleen was palpable in 45 per cent. of the cases. The stigmata in the fundus oculi must not be forgotten in the diagnosis of inherited syphilis. Craniotabes is regarded by Pernet as very suspicious of congenital syphilis.

Some facts concerning *hereditary transmission* are important.

1. Transmission may occur through the father (sperm inheritance) or through the mother (germ inheritance).

2. The disease may be transmitted by the father either during the active stage of the disease or after all signs have disappeared, yet a syphilitic father may beget healthy children.

3. Each successive child of luetic parents shows less pronounced manifestations of the disease, until finally no symptoms at all are manifest.

4. A child may be infected at its birth. Then the syphilis is congenital and not hereditary.

5. A woman may beget a syphilitic child and may suckle it without becoming infected (Colles's law), yet a healthy nurse who suckles the child may become infected. According to the law of

Colles, the mother has received protective inoculation from antitoxins absorbed from the syphilitic fetus. When both parents are infected, the child runs a double risk of infection. In infection of the mother after the seventh month of pregnancy, the child generally escapes (*vide* marriage).

Wet-nurse.—The diagnosis of syphilis in a wet-nurse is of great importance. Such a nurse can infect in all stages of the disease. It is usually supposed that individuals with tertiary lesions were only dangerous to themselves, but not to others. Williams[170] has collected twenty-five cases from the literature in which infection occurred from tertiary lesions. Experimental inoculations of the products from gummatous lesions having failed, the failures are attributed to using the degenerated in lieu of the developing parts of the gumma. Recent inoculations with material from the spreading margin of gummata have been successful in communicating the disease to monkeys. If the nurse is the subject of recent infection, skin eruptions, mucous patches, loss of hair, and swelling of the glands may be detected. The enlarged glands may direct attention to the site of the primary sore. In chancre of the vulva or lower vagina the glands in the inguinal region are involved, and those in the iliac regions when the sore is located in the upper vagina or the cervix. Skin lesions of the palms of the hands are the most persistent, hence this region must be carefully examined, even by the aid of a magnifying glass, if necessary. Other persistent lesions are found in the mouth (leukoplakia) and on the outer surface of the labiæ majora as scaly papules (*vide* acquired syphilis).

Acquired Syphilis.—The initial lesion (chancre), appearing usually about a month after exposure to infection, is at first a papule which ulcerates and the tissues around it assume a cartilaginous consistency (indurated chancre). The characteristics of a chancre may be summarized as follows (Fournier):

1. Usually a single lesion (in one hundred cases one finds eighty-one single against nineteen multiple chancres).
2. A circumscribed lesion, eroded more frequently than ulcerated.
3. An erosion habitually red, sometimes gray.
4. The lesion is generally round, but it may be oval or elliptic.

The contour is always clear and never offers the polycyclic form which characterizes herpes. If it shows excavated ulceration, it is eroded on a level with the skin, the bottom is smooth (like a well-waxed floor), and it has no raised borders. It secretes a slight amount of serous fluid.

5. The chancre is more frequently red than gray, and the somber red, like the color of muscle, is absolutely characteristic. It is painless throughout its existence unless irritated. After its cicatrization the induration persists for weeks and months.

With or soon after the appearance of the chancre there is a "stony" induration of the nearest lymphatic glands. If we regard syphilis as essentially a venereal disease, we will be inclined to overlook cases of extragenital chancre, which, according to Bulkley, occur in nearly 6 per cent. among males and almost 12 per cent. among females. In the examination of an individual negative statements of infection should be taken *cum grano salis*. The following points aid in the diagnosis of syphilitic infection:

1. History of a genital or extragenital sore succeeded by a non-itching skin eruption, sore throat, and alopecia.

2. In women the history of frequent abortions.

3. The presence of scars in the groin, leg, and elsewhere. Use a magnifying glass, if necessary. Examine the testicles for atrophy or swelling.

4. Examine the mouth for lesions and note the condition of the lymph-glands. Potter[171] investigated three hundred patients, about half of whom were syphilitic, with the object of establishing the practical value of Virchow's observation, that a smooth atrophy of the follicles of the base of the tongue occurred in syphilis. Potter concludes that a typical atrophy of these glands in a person below the age of fifty years is indicative of syphilis. A moderate atrophy is without significance. The papillary glands were examined by palpation, as the visual examination was untrustworthy.

5. The skin lesions are copper-colored without pain or itching; they show polymorphism, *i. e.*, papules, macules, pustules, scales, etc., coexist; there is a tendency for the exanthem to assume a circular form and it shows a predilection for certain parts—around the forehead (corona veneris), palm of the hand, sole of the foot, etc. Loss of hair in syphilis is rarely permanent and the bald spot

is scaly and never smooth. Berkeley Hill taught that any eruption in the palm was syphilitic.

6. One must recall that syphilitic affections of the respiratory apparatus are not infrequent (page 191), and we have reason to suspect syphilis when the pulmonary symptoms are out of proportion to the local evidence of disease, and especially when enlargement of the bronchial glands can be demonstrated. Even the presence of tubercle bacilli in the sputum does not exclude a syphilitic complication. It is usually the middle portion of the lung that is involved. Subpleural gummata and pleuritis may coexist with an interstitial pneumonia.

7. Examine the iris and note if it is dull and discolored and test the pupil to determine whether it is altered in size, sluggish in reaction, or irregular. To bring out the irregularity atropin may be necessary. The foregoing points may elicit evidence of a former iritis, which is commonly caused by syphilis. Examine the fundus with the ophthalmoscope for old or recent lesions. An Argyll-Robertson pupil always means syphilis (Babinski) and suggests commencing tabes (Moebius). If this pupillary phenomenon were more often sought, the nature of many obscure affections would be solved.

Brice suggests a curious intolerance of old syphilitics toward very small doses of copper.

8. Recent observations show that nerve lesions may occur early in the disease, even before the disappearance of the induration of the chancre. The symptoms are multiple and of such a character as could not be explained by an individual lesion; in other words, they are atypical or anomalous.

9. Syphilis of the liver may present the picture of cirrhosis or growths may be felt suggesting carcinoma.

10. Syphilis of the digestive apparatus usually involves the esophagus or rectum, resulting in stricture.

11. Syphilis of the heart is characterized anatomically by gummatous lesions, degenerations of the muscles, and obliterating endarteritis. Syphilis is an important etiologic factor in arteriosclerosis and aneurism.

12. Genito-urinary syphilis involves the kidneys either by the formation of gummata or by the development of nephritis. An

acute syphilitic nephritis is estimated in nearly 4 per cent. of the cases of syphilis in the secondary stage. The testicle may show the presence of a gummatous growth. It may be confounded with tuberculosis of the gland. In the latter affection the epididymis is involved, and not the body of the gland, as in syphilis. A syphilitic interstitial orchitis leads to a painless induration and subsequent atrophy of the testes. One testicle is usually more involved than the other.

13. In syphilis of the bones the pains are worse at night (osteocopic pains), and the bones usually involved are the clavicles, tibiæ, and skull. Intense headache may be caused by periostitis of the inner surface of a cranial bone. When the joints are involved, the pains are likewise worse at night. An arthralgia may precede the secondary eruption. In syphilitic rheumatism there are no sweats, no cardiac complications, no redness of the skin, and only a moderate fever. In tertiary syphilis the knee-joint is most frequently involved (synovitis).

14. Above all, the therapeutic test with mercury and the iodids is indicated (pages 199, 189).

Inoculation on monkeys is a reliable test, but cannot always be employed owing to the lack of subjects.

Metchnikoff has shown that syphilis may be conveyed to many animals by inoculation, but ape-syphilis has been the subject of most careful study. The incubation of the latter is from twenty to thirty days, and the chancre is first manifested either as a red prominence or a herpetiform vesicle, which is later succeeded by all the characteristic signs of the conventional specific ulcer. This experimental syphilis, as Metchnikoff suggests, may be utilized in the differential diagnosis of chancre and chancroid.

Examination for the spirocheta should only be entrusted to experts and the Wasserman serum is not trustworthy.

Mandelbaum describes the following method of staining the spirocheta pallida in the living condition: Serum from a chancre or fluid from a mucous patch is placed on a cover-glass to form a hanging drop. To this drop is added a loop of Löffler's methylene-blue and another loop of decinormal sodium hydrate solution. On examining with the oil-immersion lens the spirochetes will be seen at the edge of the drop as delicate, pale blue structures which are very different from the Spirochæta refringens. In some cases the movement of the spirochetes continues in the preparation and may be seen. When an examination for the spirocheta pallida is made for diagnostic purposes, it is often negative as a result of either local or internal treatment before the examination. Arning and Klein employ the technic of Preis in searching for the spirocheta; the chancre is first washed with petroleum ether and the deep serous secretion is spread in thin smears and covered five or six times by a mixture of 15 drops of Giemsa's stain, with 10 c.c. of water. Each time the slide is heated until vapors rise from the fluid. The parasite is found in the secondary lesions of hereditary and acquired syphilis, but rarely in tertiary lesions.

Klausner suggests the following simple test in the diagnosis of syphilis: In a glass 0.5 cm. in diameter and 7 cm. tall he mixes 0.2 c.c. of the patient's serum with 0.7 c.c. of distilled water. After thorough mixing the glass is set aside at room temperature. In the course of about fifteen hours a precipitate, in the syphilitic cases from 2 to 4 mm. in depth, or flakes float in the fluid, gradually sinking to the bottom. The control glasses show no precipitation during this period; if a little precipitation occurs by the end of twenty-four hours, it is insignificant compared with the marked amount in the syphilitic serum. As the precipitate dissolves in physiologic salt solution and in acetic acid, he believes it to be formed of globulin, and that it may possibly prove to be characteristic of all processes accompanied by formation of antibodies. The reaction was positive also in two cases of severe croupous pneumonia and in one of typhoid, but by diluting the serum to 1 : 5 or 1 : 10, there was no further reaction in these cases, while the reaction occurred unmodified, even with this dilution, in the cases of syphilis.

Tonsillitis.—The tonsils are now regarded as portals of infection, and are thus indirectly responsible for many diseases. Attention has been directed to acute tonsillitis as a forerunner of chorea, endocarditis, erythema nodosum, rheumatism, etc. The association of articular rheumatism with tonsillar conditions has led Gürich to incise and remove the suppurating crypts of the tonsils. If the majority of the latter are incised at one sitting, the fever and pain may subside within an hour. On the second to the fourth day, there may be an exacerbation of the rheumatic phenomena (reaction). Among one hundred and forty cases so treated, ninety-eight made a permanent recovery. One attack of tonsillitis predisposes to another. A bacteriologic study of the tonsillar crypts will reveal all kinds of micro-organisms, and the wonder is that the tonsils are not more often accused as factors in the etiology of disease. A superficial examination means nothing. With a simple suction apparatus products may be aspirated, and this simple method should not be ignored in diagnosis. There is only one radical measure in treatment, and that is tonsillotomy or tonsillectomy.

Chronic tonsillitis is frequently associated with hypertrophy of the adenoid tissue (pharyngeal tonsil). Tonsillar hypertrophy may occur as a congenital condition in association with an increase of all the lymphoid tissues (lymphatism) or the proliferation may be excited after acute infections in children. It is a frequent condition, although Meyer demonstrated its existence in only 1 per cent. of the children examined in Copenhagen, and Chappell in sixty cases after an examination of 2000 children in New York.

The size of a tonsil is no evidence that it is infected. A tonsil which does not protrude (submerged tonsil) may be as diseased as one that protrudes beyond the pillars. The lymphatic drainage of the tonsils is into the tonsillar glands located on either side at the angle of the jaw in front of the sterno-mastoid muscle and their enlargement may be the only evidence of tonsillar infection.

Adenoids prevent the mental and physical development of the child, and even after their removal respiratory gymnastics must be executed as an essential part of the after-treatment. It is not difficult to recognize pronounced types of adenoid vegetations. Mouth-breathing is a common symptom. Sleep is disturbed and the respirations are irregular and noisy. Attacks of dyspnea may occur and a persistent, nocturnal, paroxysmal cough (Balne's cough). The expression is apathetic and stupid-looking, which is accentuated by the open mouth. The lips are thick, nasal orifices small, the roof of the mouth is high, and the superior dental arch is narrowed (Fig. 110). Mayer[172] regards it as an axiom that the presence of large follicles on the posterior pharyngeal wall (diagnosed as follicular pharyngitis in adults) is, in young children, not previously operated upon for adenoids, absolutely diagnostic of their presence in the vault of the posterior nares. Enlarged tonsils may or may not exist. A digital examination of the nasopharynx is diagnostic.

The child should be seated in a chair or held on the right knee of the assistant, while the physician stands behind to the right side of the child. With the left hand around the head and neck of the child, and holding it firmly against his body while the assistant holds the hands, the physician pushes the left cheek between the teeth of the open mouth by the left thumb. After this the right forefinger is carried up toward the nasopharynx, and instead of palpating thin mucosa covering the bones, a soft mass, feeling like a bundle of worms, is found to fill the nasopharynx if adenoids are present. The examining finger, when withdrawn, is covered by mucus and blood, whereas in the norm no bleeding follows palpation. The chest of the child shows all kinds of deformities; barrel-shaped when asthma coexists, funnel-breast, and the pigeon-breast, the most frequent variety. During inspiration the lower portion of the chest is retracted. Mouth-breathing and stuttering are frequently associated, the voice has a nasal quality, and there is an imperfect pronunciation of the nasal consonants *n* and *m*. Impaired hearing may account for the indisposition for mental exertion. The term aprosexia has been given to the peculiar mental state which prevents the subject from fixing the attention. Headaches and all kinds of nervous symptoms are associated with

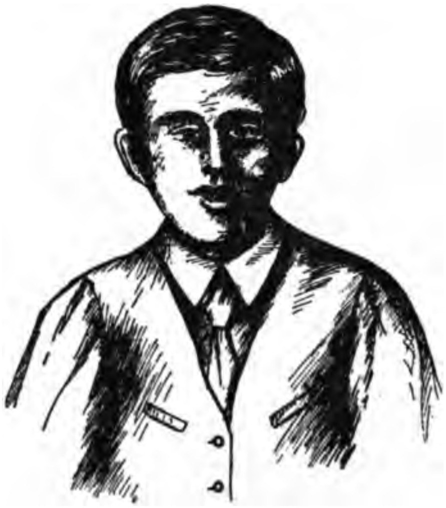

Fig. 110.—A mouth-breathing boy. The nostrils are small, the nose relatively insignificant, the mouth large and constantly open; the lips are thick and dry, the eyelids droop, and the expression is stupid.

adenoids. The vegetations may undergo spontaneous atrophy after the fifteenth year, at a time too late, however, to repair the damage done, or they may become cystic (Thornwaldt's disease). If examinations for adenoids were made more frequently, the cause of frequent attacks of cold in the head, various neuroses, ear-affections, throat, and general infections, would be discovered. In adults adenoids may be suspected when chronic post-nasal catarrh, deafness, or muffling of the voice are present. Even though adenoids have been removed, their subsequent recurrence is possible.

Typhoid Fever.—No tissue of the body is exempt from invasion in this disease, hence the sequelæ are many. The typhoid bacilli have been found in many of the lesions. Affections of the heart involving the endocardium, pericardium, and myocardium date from an attack of typhoid. Endarteritis is frequent (thirteen times in sixty-two cases reported by Thayer) and thrombosis in the veins is more frequent than in the arteries. Bernheim refers to the frequency of cholelithiases after typhoid fever. Cushing found typhoid bacilli in a patient with cholecystitis who had never had typhoid fever. Neuritis may occur during the disease or after convalescence and a post-typhoid neurasthenia may persist for years despite treatment. Otitis media is present in a small percentage of cases. Nephritis and a post-typhoid pyelitis are other sequelæ. Many cases of tuberculosis regarded as sequelæ of typhoid are really cases of tuberculosis from the start, for it is well known that before the Widal test was used, the differential diagnosis between general miliary tuberculosis and typhoid fever was exceedingly difficult. The ophthalmo-toxic reaction of typhoid fever seems destined to succeed the Widal reaction as an early sign of this fever. This sign, first reported by Chantemesse (Paris Academy of Medicine, July 23, 1907), consists of dropping into the eye of a patient a product obtained from the cultures of typhoid bacilli. When the reaction is positive, congestion, lacrimation, and a sero-fibrinous exudate develop within twelve hours, and may continue for two or three days. In the event of a negative reaction the ophthalmic reaction is of short duration (usually four, and never longer than twenty-four, hours). Osseous lesions are frequent sequelæ, although they may occur during the disease. The lesions chiefly involve the bones of the legs, and consist of periostitis, necrosis, and caries. The lesions are characterized by chronicity and recurrence. Arthritis is not a frequent complication and spontaneous dislocations, especially of the hip, occur. The so-called *typhoid spine* is a neurosis, and is initiated by pains in the lumbar and sacral regions. The back becomes stiff and movements cause pain. There is also pain on pressure in association with nervous symptoms. The prognosis is good.

DIATHESES.

Formerly the diathetic theory of disease was so much abused that at the present time diathesis, which signifies a congenital condition of the body which predisposes to certain diseases, is accorded only inconsiderate attention in our text-books. Thus, in Foster's medical dictionary seventy varieties of diatheses and over twenty varieties of dyscrasia are described. The prevailing germ-theory of disease seeks to substitute the diathetic theory by supposing that exposure to infection, rather than a special diathesis, accounts for the development of disease. In other words, we do not inherit germs, but we inherit vulnerable tissues incapable of resisting the omnipresent germs. There is no doubt a modicum of truth in the germ-theory and in the theory of the hereditarian. Both theories are no doubt correct, but they are circumscribed. When the hereditarian contends that "The gods visit the sins of the fathers upon the children"; that "We are omnibuses in which all our ancestors ride"; and that "The life of each individual is, in some real sense, a continuation of the lives of his ancestors"—he obtrudes a pessimistic fatalism which seeks to eliminate the personal equation as a factor in disease, thus limiting the responsibility to heredity. Tuberculosis may be selected as a paradigm of a hereditary disease. The physician correctly assumes that there is an inherited predisposition to the disease, but if he were wholly dominated by the pessimistic fatalism of the hereditarian, he could extend no hope to the individual. On the other hand, a strong family history and the stigmata of tuberculosis cannot be ignored. Those who would deny the contention of the hereditarian that tuberculosis is a congenital disease attribute altogether too much importance to the rôle played by the tubercle bacillus, a mere accident in the production of the disease. Inheritance counts for much. Tissue susceptibility is less capable of demonstration than the bacillus, hence as a factor in the disease it has been regarded inconsiderately. The complex nutritional processes in the body-cells through which physiologic factors are constantly at work to secure natural immunity are imperfectly understood, although we cannot help but realize that disturbances of the natural protective forces, by diminishing the resistive power, invite bacterial invasion; just as certainly as susceptibility may be congenital, so may natural immunity be acquired. Acquired immunity is a question of environment, climate, sunshine, air, food, habits, etc.

Two factors are recognized by biologists as responsible for the actions and character of the living organism, viz., heredity and environment. It is often difficult to determine whether a specific vital phenomenon is a result of inheritance or a reaction to environmental influences. Resemblance to ancestors is an acknowledged product of inheritance. Galton has estimated that of the total heritage of the child, each of two parents contributes one-fourth, each of the four grandparents one-sixteenth, and the remaining one-fourth is handed down by more remote ancestors. The congenital resemblances may be anatomic, as expressed by physical resemblances (facial features, stature, color of hair and eyes) or by anatomic defects of the eyes, cleft palate, monstrosities, etc. They may be physiologic, as expressed by characteristic gestures, peculiarities in gait, tendency to obesity, to longevity, and to certain diseases, such as gout, asthma, and epilepsy. They may be psychologic, as expressed by artistic and moral qualities, traits of character, temperament, mental diseases, and proclivity to crime and suicide. Characters transmitted from grandparent to child and never appearing in the parent are referred to as latent characters. Latent characters are very often associated with sex. Character latent in the intermediate ancestor is evidenced by the appearance of the female characteristics in castrated males, and of male characteristics in females with diseased ovaries. Latency is further expressed by *atavism* or reversion, terms which refer to the appearance in an individual of peculiarities known only in remote ancestors, but not in the parent of the individual. Darwin instances many examples of reversion, such as the frequent appearance of stripes upon the legs of the mule, the latter being a hybrid from the horse and the ass, both of which are comparatively unstriped, but are unquestionably descended from a striped zebra-like ancestor. The same writer attributes the degraded state of half-castes to reversion to a primitive savage condition, which, usually latent in both civilized and savage races, is made manifest in the offspring that results from the union of both. *Regeneration* is likewise a phenomenon of heredity, and refers to the capacity of the organism to replace parts lost by accident or destroyed by disease. The regenerative power becomes progressively stronger as we descend in the scale of animal life. Thus, a newt may replace a lost leg; a crab, a lost claw; the snail, an eye stalk or eye. A hydra may be cut into pieces and each piece may re-grow into a complete hydra. If an earth-worm is divided, one-half may regenerate a new half which is in every respect complete. The inheritance of disease is not always the transmission of an actual parental disease; on the contrary, a diseased parent may produce offspring that are constitutionally weak, and the disease of the parent may later on attack the constitutionally weak body. Without entering into a discussion of the theories of inheritance, modern biologists attribute much truth to the theories of preformation and epigenesis. The first is practically the Darwinian theory of pangenesis. It assumes that the cells or units of the body increase by cell-division or proliferation, retaining the same nature, and that they ultimately become converted into the various tissues and substances of the body. Aside from this means of increase, the cells throw off minute granules which are dispersed throughout the whole system; that these, when supplied with proper nutriment, multiply by self-division and are ultimately developed into units like those from which they were originally derived. These granules are collected from all parts of the system to contribute the sexual elements, and their development in the next generation forms a new being; but they are likewise capable of transmission in a dormant state to future generations, and may then be developed. Their development depends on their union with other partially developed or nascent cells which precede them in the regular course of growth. The granules are thrown off by every unit, not only during the adult state, but during each stage of development of every organism. The granules in their dormant state have a mutual affinity for each other, leading to their aggregation into buds or into the sexual elements. Therefore it is not the reproductive organs or buds which generate new organisms, but the units of which each individual is composed. Thus the theory of Darwin explains the regeneration of lost parts by supposing that the granules of the part in question are disseminated throughout the body and have only to unite with the nascent cells at the point of new growth. The theory also explains reversion by supposing that the granules lie dormant in one generation and develop in the next. It further explains how acquired variations may be congenital, since an altered part throws off altered granules, and by collection of these in the germ cells the alteration may be transmitted, thus explaining the transmission of acquired characters. The theory of epigenesis assumes that there is no preformation in the germ cells, but rather a lack of organization, which during growth, under guidance of a mysterious power, gives place to differentiation and the appearance of definite parts. Much experimental work is now being done, chiefly on marine invertebrates, to determine how many of the characteristics of the offspring are due to the original qualities of the germ plasm and how much to the physical, chemical, and physiologic phenomena of the immediate environment of the developing embryo. Applying the foregoing facts to the heredity of nervous disease, we have, first of all, the fact that a nervous disease is rarely directly inherited. What is really transmitted is a general predisposition to nerve disease, the subjects having inherited unstable and irritable nervous systems; they possess, in other words, what is known as a neuropathic constitution. Individuals of genius are neurotics, as a rule, and may beget a progeny with neuropathic constitutions, but such a tendency would be less likely, if one of the parents were of a phlegmatic temperament. Shock or injuries to the mother during the early months of pregnancy may lead to nervousness in the offspring. There are so-called family diseases which may be transmitted by direct inheritance from parent to child, or may skip a generation. In the latter instance we have a manifestation of atavism which rarely goes back more than two generations. Morbid traits, peculiar to a family, may reappear at the same age in the offspring, but if such traits show a tendency to disappear with each successive generation, they appear later in life in the descendants. If such traits become exaggerated, they appear at an earlier age in the descendants.

Apoplectic Habitus.—Habitus refers to the general appearance or expression. The individual predisposed to apoplexy is described as a stout person, of average size, short-necked, and full-blooded. Premonitory signs are occasionally present in apoplexy from which individuals with this habitus may suffer, viz., fullness in the head, tinnitus, vertigo, headache, numbness and tingling pains in the limbs, loss of memory, and choreiform movements (prehemiplegic chorea). The lesions in apoplexy are practically confined to the cerebral arteries, hence all conditions which can cause arterial degeneration predispose to cerebral hemorrhage. In this sense the conditions can be acquired or are hereditary. In the former category belong syphilis, alcoholism, and excessive eating. The conviction is rapidly gaining ground that the poisons absorbed from the intestinal canal are largely responsible for degenerative arterial changes. Heredity influences cerebral hemorrhage by inducing degenerative changes in the arteries. Early arteriosclerosis may be a familial disease, just the same as other anomalies of defect, like hemophilia, albinism, Daltonism, ichthyosis, and myopia, which run in families. Thus longevity is a vascular question, as Osler puts it, and "a man is only as old as his arteries." The early predisposition to arteriosclerosis is explainable in no other way than "that in the make-up of the machine bad material was used for the tubing. More commonly the arteriosclerosis results from the bad use of good vessels." The diagnosis of this habitus concerns itself with the condition of the arteries (*vide* diagnosis of visceral sufficiency).

The Exudative Diathesis.—This diathesis, first described by Czerny, appears during the first weeks of life and persists until puberty or later. It is characterized by the geographical tongue, "cradle-cap" (a yellowish-gray desquamation in the region of the large fontanel), recurring attacks of asthma, enlarged cervical glands, and lymphatic enlargement of the pharynx.

Gouty (Arthritic, Uric-acid, Lithemic) Diathesis.—The gouty individual is described as robust, with well-developed body, florid face, excellent digestion, and a strong heart with arteries showing high tension. A history of heredity can be obtained in about 55 per cent. of the cases. Heredity is more pronounced in the male line, and while the disease usually appears after the age of forty years, it has been observed before puberty, and even in infants at the breast. In the diagnosis of this diathesis there are several points of value. Typic attacks of acute gout offer no difficulty in diagnosis; the dilemma obtrudes itself in recognizing the symptoms of atypic or chronic gout. It is evident to clinicians that many symptoms are called gouty in deference to convenience rather than scientific accuracy. Thus, no condition with an obscure etiology has escaped the accusation of being gouty. Obscure headaches, pyorrhœa alveolaris, itching of the palms and soles, lumbago, bronchitis, cutaneous eruptions, affections of the eye, etc., are included in this category. A history of heredity plus exciting factors, like overeating with little exercise, plumbism, and alcoholism, is cogent presumptive evidence of gout. Recurring paroxysms of pain implicating the big toe at the metacarpophalangeal articulation or other articulations in the foot with a gouty history suggest the nature of the trouble. Several joints may be affected, intimating the polyarthritis of acute rheumatism; but, as Osler observes, the absence of fever indicates gout. Examinations of the urine demonstrate that the uric-acid output at the height and just after an attack is greatly augmented, whereas in the interparoxysmal periods it is usually low. The physician may employ the following method of Gubler, which is approximately accurate, in estimating the quantity of uric acid; if albumin is present, it must be removed by boiling, after slight acidification. Upon a layer of nitric acid in a test-tube stratify the urine so that the volume of the latter is to the volume of acid as 3:2. At the junction of the-two fluids a cloudy ring of uric acid appears within five minutes if the uric acid is increased in amount; if diminished, not until later. This test assumes that the daily volume of urine is normal; and if the volume is diminished, the urine must be diluted up to the normal amount with water.

Haig observed that the administration of acids in gouty subjects produced pricking and shooting pains in joints, especially in those which had been most used, and Garrod made a like observation in gouty subjects after the ingestion of beer or wine. The discovery of a single *tophus* may clinch the diagnosis of gout. The pathogeny of gout is identified with an excess of uric acid in the blood, and it is deposited as sodium urate in the tissues as various sized nodules, known as tophi. The tophi are superficial and are seen as whitish nodules in the cartilage of the ear at the margin of the helix. Other cartilages (nose, eyelids, and larynx) are less frequently invaded. The tophi are found practically in every tissue and organ of the body, except the nervous system. Incision of a tophus gives exit to a chalky material, the nature of which can be established by the murexid test (page 308), or, upon the addition of a drop of nitric acid, the crystals of nitrate of urea (Fig. 83) may be detected. Duckworth found tophi in the cartilage of the ear in one-third of his cases, and they are frequently encountered there long before the arthritic manifestations. Ebstein has observed nodules in the ear which are in no way related to gout. They are, however, located in the substance of the cartilage, and not like the nodules in gout, in the cutaneous and subcutaneous tissue. Examination of the material from the nodule already referred to makes the diagnosis absolute.

The Spasmophilic Diathesis.—This refers to a condition occurring during childhood in which there is an abnormal excitability of the peripheral motor nerves, manifested clinically as tetany, laryngeal spasm, and general convulsions. The chief point in the diagnosis is the excessive excitability of the nervous system to galvanic stimulation (the cathode opening contraction occurring with currents of less than 5 ma., and the anode opening contraction exceeding the anode closing contraction). The condition is identified with artificial feeding and the cases yield to breast-feeding.

Hemorrhagic Diathesis.—Uncontrollable bleeding occurring either spontaneously or from trifling wounds is known as *hemophilia.* It is usually evident within the first two years of life. Many members in a family are affected and bleeder families are usually large. The male are more often affected than the female members of a family in the proportion of 11:1 (Legg) or 4:1 according to Stempel. The Anglo-German races preponderate in the list of reported cases. The pathogenesis is obscure. Spontaneous hemorrhages into joints may be accompanied by swelling, fever, pain, and other symptoms of arthritis. In the diagnosis of this condition primary attention must be directed to the coagulation time of the blood (page 151), which is retarded. The subjects present all the evidence of health and possess soft fine skins. There is a form of hereditary *epistaxis*, with dilated nevi in the nose or mouth and cutaneous nevi (telangiectases), which must not be confounded with hemophilia.

Neurotic Constitution.—We comprehend by neurotic heredity a number of nervous diseases of direct hereditary character, transmitted from generation to generation. The hereditary taint may vary in degree from epilepsy and insanity to the less serious heritage, neurasthenia. The indications of a neurotic heredity known as stigmata may be manifested by defects of the moral sense, of memory, attention, will, or judgment. The stigmata of the degenerate may be physical, psychic, or both. All writers who have made a psycho-anthropologic study of degenerates do not attach the same significance to physical stigmata as does Lombroso. The stigmata in question are: cranial and facial deviation, recession of the lower jaw, large or small mouth and thick lips, abnormally shaped and misplaced ears, defective and misplaced teeth, and high palate. Some of the psychic stigmata are: (1) Precocity or retarded evolution of intellect; (2) extreme changeableness and irritability; (3) exaggerated consciousness and a fanatical religious zeal or great moral depravity; (4) intense egotism with no regard for the feeling of others; (5) extravagant and cranky motives and desires; (6) one-sided talents and disproportionate development of the mental faculties.

According to a biologic law, the nerve-centers which develop late are the least organized and most susceptible to morbid influences. Van Gieson, in referring to the heredity of neurasthenia, says: "The potential energies of the higher constellations of their association centers have been squandered by their ancestors."

Neurasthenia.—The tale of every neurasthenic may be written in four chapters: (1) The sins of the fathers. (2) The birth of a neurotic. (3) Struggle for existence on deficient nerve-capital. (4) A bankrupt nervous system. Throughout the narrative the continuity of human folly remains unsevered.

"The Autocrat at the Breakfast Table" observes that "it is better to lose a pint of blood from your veins than to have a nerve tapped." "The best receipt for longevity is to get neurasthenia at an early age and nurse yourself until your death."

Post-infectious neurasthenia is a frequent sequela of syphilis, gonorrhea, typhoid fever, influenza, etc. Among the neurasthenic stigmata described by Charcot are: (1) Pain and pressure in the head; (2) insomnia; (3) spinal hyperesthesia; (4) muscular weakness; (5) nervous dyspepsia; (6) anomalies of the genital organs; (7) psychic depression, intellectual fatigue, incapacity of decision, irritability, feelings of anxiety, etc.

The chief symptom of neurasthenia is tire. Without the latter sign, the disease cannot be said to exist. Marcet has shown that the time during which an individual can sustain a voluntary muscle contraction is determined by the endurance of the brain-centers engaged in the act of volition, rather than by the muscles themselves. The very moment these centers are exhausted the muscle contraction gives way. Volition can be fatigued when exerted in imagination as well as in actual muscle effort. The neurasthenic symptoms of a single organ may dominate the entire picture of neurasthenia. In psychic neurasthenia psychic symptoms predominate: insomnia, pressure sensations in the head, headache, vertigo, irritability, anxiety conditions (fear of insanity and anxious feeling located over a particular region), phobias, and hyperesthesia in special regions of the body. In spinal neurasthenia there is local tenderness of the spine, and pain in the spine (rachialgia) radiating to the legs and viscera, associated with disturbances of sensation (numbness and tingling) and disturbances of coördination. Amyosthenic symptoms may be present, characterized by insufficient innervation of the muscles, notably of the eye, leading to ptosis and asthenopia. The symptoms may suggest tabes when the Romberg symptom (difficulty in standing when the eyes are closed) is present, or general paresis when coördinated acts like writing and articulation are defective and the pupils show inequality. This hypotonicity of the muscles in neurasthenia may also be noted in executing other unaccustomed movements of the muscles of the hand. This amyosthenia (failure of muscular strength) is also noted when the patient is directed to raise the body by the ends of the toes.* Vasomotor disturbances are manifested variously:

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* Muscular relaxation (*hypotony*) is an early sign of tabes which is thus determined by Jendrassik: As the patient stands, the distance from the floor to the great trochanter and the seventh cervical vertebra is measured, after which the patient stoops forward with stiff knees as far as possible and the measure is again taken. Normally, the vertebra mentioned cannot be brought to or below the level of the trochanter, but in hypotonicity, it may be brought 21 or more cm. below the level of the trochanter.

flushes, sweating, and a throbbing aorta or other blood-vessels. Stiller refers to a sign present in a large number of neurasthenics, especially those who are lean and dyspeptic, viz., a mobile tenth rib (*costa fluctuans decima*), which is not fixed with the cartilage to the other ribs, but is either wholly free (or floating) or attached only with ligaments. This mobile rib is said to be quite common in delicate children, and that they are apt to become neurasthenics or enteroptotics later in life, according as nervous or dyspeptic symptoms predominate. The Rumpf symptom consists of making pressure over some painful point in the body which will bring up the pulse from 80 to 90 to over 100, and it will remain there for one or two minutes.

Erben observed that the customary increase in the pulse rapidity that follows the movements of the body did not take place in a large number of neurasthenics, if the patient bent far forward, or, as Ortner pointed out, if they bent their heads backward. After either posture it was observed that after continuing its rhythm for from 4 to 15 beats, there was a sudden retardation of the pulse, which continued for about 16 beats, after which the pulse gradually attained its former rapidity. Brain-tire (cerebrasthenia) and inability to concentrate the attention may be determined in a number of instances by having the patient add up a row of figures. It has been noted, in testing the visual field in neurasthenia, that when an object is brought from without into and across the field of vision it is seen in wider range than when it is placed in the center of vision and carried gradually outward toward the periphery. This is known as "Foerster's shifting type," and is the reverse of the normal condition. Nervous instability may be manifested by *hippus*, *i. e.*, an alternate contraction and expansion of the pupils when the patient views a distant object without any effort at accommodation.

A sign which I have noted in many neurasthenics is as follows: Either hand is placed in the position as indicated in Fig. 111, to relax the muscles. By stroking the skin with the finger on the inner or lower surface of the radius at a point just above the styloid process, a tingling sensation is experienced in one or all of the fingers. Some patients describe the sensation as an "electric shock." The irritable region corresponds to the musculo-cutaneous nerve. Usually the median nerve on the anterior surface of the wrist in about the median line is equally irritable to stroking. In addition to this, the hand remaining in the same posture, pressure by means of the finger at a point on the dorsum of the wrist equidistant from the styloid processes of the radius and ulna will elicit extension of the thumb and index-finger and adduction and flexion of the middle finger. The latter reflex is also present in the norm, but never as pronounced as in the neurasthenic subject. The hyperesthesia and reflex are excellent indices of the nervous condition; thus they are less evident in the rested than in the exhausted state of the subject. Critzmann regards an absence of the *cremaster reflex* as symptomatic of hereditary neurasthenia. In hysteria unassociated with neurasthenia or an asthenic condition the cutaneous reflexes are usually intact.

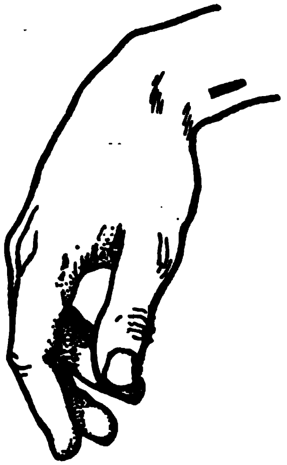

Fig. 111.—Position of the hand for testing the nervous condition. The black line corresponds to the location of the musculocutaneous nerve.

Of late, the tendency has been manifest to subdivide the neuroses, and a new mental disorder, **psychasthenia,** has been added. Neurologists maintain that the psychasthenic state is frequently confused with hysteria and neurasthenia. Thus hysteria is associated with suggestibility and neurasthenia with fatigability. While the author does not believe that there is a decided difference among these neuroses, yet he must submit to the weight of authority on this subject. Psychasthenia is exhaustively discussed in "Les Obsessions et la Psychasthenie," by Janet. The so-called phobias and obsessions, according to our modern conception, are not neurasthenic but psychasthenic symptoms. In psychasthenia the symptoms are periodic, and anything which diminishes the general vitality causes a recurrence of symptoms. In a word, psychasthenia refers to the formerly recognized mental symptoms of neurasthenia without the fatigue of the latter affection. In this, like the other neuroses, the rest-cure is often indicated.

Hysteria.—This affection is common in women, but male hysteria is by no means infrequent. It is confined to no age (page 16), and the severer forms are frequent in people of the Latin race. Heredity is a factor in the etiology, but any education which fails to inculcate the doctrines of self-control cannot be ignored. Traumatism is also a factor. Hysteria is usually divided into a convulsive and a non-convulsive form. The convulsive is further divided into minor and major forms. The attacks of the minor forms are preceded by symptoms called auræ, consisting of laughing and crying spells, a lump in the throat (globus hystericus), etc. Then a convulsion follows, with irregular movements of the head and arms. The patients do not fall suddenly, as in epilepsy, but they usually select a spot with due regard to their personal safety. Unconsciousness is the rule during an attack, followed by profound sleep or catalepsy. In the major form (hystero-epilepsy) the attack resembles that of true epilepsy. Convulsions may continue for several days in succession, just like the status epilepticus; but, unlike the latter, the prognosis is good and there is usually no fever.

The convulsive movements in hysteria are performed in a more coördinate manner than in epilepsy; the hands are thrown about in all directions, as though reaching for certain objects; the face does not show the placidity of epilepsy, but an expression of fear, anger, or ecstasy; the pupillary reflex is not lost in hysteria; the attacks in hysteria are of longer duration. In the non-convulsive variety paralyses of all kinds are simulated with such nicety that even an expert often finds difficulty in distinguishing the genuine from the counterfeit syndrome. Disorders of sensation, visceral manifestations, and joint affections are added to the symptomatic picture. The mental state of the hysterical subject lies on the border-line of sanity and insanity. When fever is present in hysteria, meningitis, peritonitis, and even phthisis, may be counterfeited. Let us pass to a consideration of some facts which are of importance in diagnosis.

Diagnosis.—The stigmata of hysteria are characterized by mobility, variability, and incertitude. "Hysteria," said Lasègue, "is a basket into which we throw the papers that we do not know how to classify." It counterfeits organic disease too such a degree that often about the only thing you can positively exclude in hysteria in a female is an enlarged prostate. Again, organic disease may parade in the guise of hysteria, and the physician who fails to exclude an organic factor before making a diagnosis of hysteria will be credited with many egregious blunders. *Anesthesia* is a common stigma and patients are usually unconscious of its existence. The distribution of anesthetic areas is not anatomic. Loss of sensation to touch (anesthesia) is often associated with loss of sensation to pain (analgesia) and a pin-prick may not be followed by blood (vasomotor disturbances). The anesthesia may be confined to one side of the body (hemianesthesia), usually the left, is limited by the median line, and involves the mucous membranes (conjunctiva usually not implicated) and deeper parts. In other instances analgesia is limited to certain regions or it may include the entire surface of the body. In the latter instance a small area may be found which is not analgesic, a fact of great value in the diagnosis of hysteria. If the anesthesia is bilateral and limited to the two lower extremities, the sensibility of the genitals and a triangular area on the sacrum is retained. Certain maneuvers will reveal the hysterical character of the anesthesia. One maneuver, known as *transference*, is to place a plate of metal somewhere in an anesthetic area in hemianesthesia; in that area sensibility returns, and the corresponding area of the other half of the body will become anesthetic. The maneuver may be reversed, by placing the metal first over an area of normal sensibility; this in turn becomes anesthetic, and sensibility is restored in a corresponding area on the other side. Contractures, paralyses, and other manifestations of hysteria may similarly be transferred. Janet suggests an ingenious maneuver. The patient, let us assume, has an anesthetic area of the left leg. He is told to say "yes" each time the right limb is touched and "no" each time the anesthetic one is touched. The eyes of the patient are bandaged, and the physician must execute his part of the performance arhythmically so that the subject has no previous warning. It is not astonishing if "yes" is said when the limb with normal sensibility is touched, but if "no" is said when contact is established with the anesthetic limb, the nature of the anesthesia is revealed, insomuch as the patient could not say "no" if tactile sensation were not present.

Among the stigmata of hysteria Janet suggests a condition of exaggerated absent-mindedness. The patient observes but one thing at a time and can perform one action at a time. Thus, you ask the patient to make a certain movement continually, such as moving her right hand on the table as if she were playing the piano. At the same time she is requested to execute some other simple act, such as reciting numbers, opening or shutting her mouth. One remarks that the first movement invariably ceases as the second begins, and only recommences at the end of the second movement.

Hyperesthesia is another stigma. It is manifested by an excessive sensibility to tactile and other impressions. Hyperesthetic areas (hysterogenic zones) are present over the skin of the thorax, abdomen, back, and ovarian region, and pressure of such zones not only reveals increased sensitiveness, but it also excites, and if maintained will arrest, a hysterical paroxysm. Hyperesthetic areas may be subjective, *i. e.*, the patient complains of localized pains in definite areas (sagittal suture and occiput) and they are compared to the driving of a nail into the part (clavus hystericus). In other instances the pains are limited to the spinous processes. The pains in hysteria are often caused by psychic irritation and are known as "hallucinations of pain." The stigmata of the special senses consist of retinal anesthesia or hyperesthesia, retraction of the field of vision, hysterical deafness, etc.

Paralyses.—In hysteria disturbances of motility are essentially paralyses of function or will-power. In one class of cases certain movements are impossible, like walking and standing, whereas all other functions may be executed by the same muscles. Thus, there is a condition known as astasia-abasia, in which the patient is unable to stand or walk without falling. In another class the paralysis may be total (hemiplegia or paraplegia). The hemiplegias are usually on the left side, the face is unaffected, and the leg is more involved than the arm. Sensation on the affected side is either diminished or lost. In paraplegia the paralysis is not always absolute. The reflexes are intact or exaggerated. The electric reactions are normal and there is no muscular atrophy. Bladder symptoms common in organic paraplegia are usually absent in the hysterical form. The hysterical monoplegias may be limited to the face (facial), leg (crural), or arm (brachial). If the affected muscles offer any resistance to passive movements, it is very suggestive of hysteria. Hoover's sign for the detection of malingering and functional paralysis of the lower extremities is as follows: In the norm, when a person lying on a couch in the dorsal posture is requested to raise the right foot off the couch with the leg extended, the left heel digs into the couch as the right leg and thigh are elevated; in other words, the left heel is used to fix a point of opposition. If a normal person is requested to press the right leg against the couch, there will be a counter-lifting force shown in the left leg. In true hemiplegia or monoplegia of a leg, in any attempt to raise the extended paretic leg, there is always some opposition in the unaffected leg. If the hemiparetic is requested to lift the normal leg off the couch, the opposition with the paretic leg is directly proportional to the voluntary muscular strength which he is able to employ. This complemental opposition is present in the norm, and in genuine paresis or paralysis, but absent in the malingerer and hysteria, and signifies the existence of cerebral inhibition.

Beevor[379] directs attention to the fact that in many cases of *functional paralysis* the patient shows an inability to inhibit the antagonistic muscles. This condition can often be seen in the knee, and for this purpose the patient lies with the face downward and the leg is put at right angles to the thigh and the patient is directed to extend the knee against resistance. Normally the hamstrings should be relaxed at once, but in these cases these muscles can be seen and felt to contract along with the extensors.

In the ankle-joint the same thing can be seen by telling the patient to dorso-flex the ankle against resistance. In a normal person the antagonists—the calf muscles—would be relaxed, but in these cases the Achilles tendon can be felt to tighten in place of being relaxed. In all these cases it is necessary for the observer to fix the limb and prevent it moving; otherwise, as the joint is extended or flexed, the antagonists may be passively drawn on and give the impression that their muscles are actively contracting.

Janet[376] emphasizes the following facts in the diagnosis of hysterical paralysis:

1. The paralysis never affects only one muscle, but a group which is necessary to a function of a part of the body, and it does not extend beyond the limit of the muscles necessary for the functioning of this part of the body.

2. The paralysis is exaggerated. In hemiplegia consequent on a hemorrhage there may be some little movement and the patient attempts to conceal the paralysis.

3. There is usually no atrophy nor disturbances of the electrical reactions and the reflexes are present.

4. The anesthesia associated with the paralysis assumes the form of geometric segments. In localizing the anesthesia the patient seems to attend to the popular conception of the organ rather than to its anatomic conception. Thus the hysteric person who paralyzes her hand does not seem to know that the immobility of her fingers is due in reality to a muscular disturbance in the forearm. She stops her anesthesia at the wrist, as would the vulgar, who in their ignorance say that if the hand does not move, it is because the hand is diseased.

If the arm of an individual who claims that he is paralyzed is passively raised to the level with the head and the individual is instructed to bring his arm down slowly, and does so, it is proof of malingering, insomuch as in real paralysis the arm drops when released (Bum).

One must never forget that hysterical may follow genuine paralysis, even after the latter has been cured. Hysterical stigmata may be present, the tendon-jerks are active, and by making unexpected passive movements of the affected limb a slight resistance may be felt in the muscles.

The Babinski toe phenomenon (*vide* pathologic reflexes) is an important sign in differentiating organic from functional lesions which simulate them. Joseph Collins, of New York, in commenting on this sign in differentiating hemiplegia of hysterical or organic origin, says that the occurrence of the Babinski toe phenomenon makes it absolutely certain that it is not hysterical. In the same way it is often of the greatest importance in differentiating hysteria from disseminated sclerosis. As a matter of fact, it may be stated positively that it never occurs in an individual above one year of age who has not had an organic nervous disease which implicates the upper motor neurons, *i. e.*, the neurons extending from the cortex of the brain to their distribution around the ganglionic cells of the anterior horns of the spinal cord and oblongata. In infants up to one year of age, *i. e.*, before the primary motor neurons are clothed with their normal myelin sheaths, the Babinski jerk is a natural possession. In several cases of hysteria I have noted the presence of the Babinski phenomenon, and, from its character and mode of elicitation, it rather aids in the diagnosis of hysteria. It is not slow as in organic disease, but spasmodic, and the muscles of the leg show contraction; it may be elicited by stroking any part of the foot.

Professor Freud's theory of hysteria, advocated by some and condemned by others, supposes that every case of hysteria is traceable to an actual but forgotten occurrence, and generally to a painful emotional shock or mental trauma, and that the circumstances of the forgotten trauma may usually be elicited by hypnosis; that when this buried reminiscence is translated into the awakened consciousness of the patient, an adequate motor expression is given to the recollection and the hysterical symptoms disappear. When the idea is repressed, the psychic excitement finds expression in somatic symptoms. In hysteria and neurasthenia he claims that the "*vita sexualis*" is abnormal, and that without repressed sexual episodes in early childhood there can be no hysteria.

Contractures.—Tonic muscular spasms may involve any group of voluntary muscles, and may be monoplegic, paraplegic, or hemiplegic. The diagnosis of hysterical contractures has been discussed (page 209). Contractures may be present with or without anesthesia and paralysis.

Spasms.—These are clonic, in contradistinction to contractures, which are tonic spasms. Occurring rhythmically, they are frequently mistaken for choreic movements. The movements may be limited to the arm, muscles of the jaws, sternocleidomastoid, rotary muscles of the head, psoas muscles (rhythmic lifting of the leg eight or ten times in a minute), or the muscles of the back, causing bowing movements (salaam convulsions). Tremor may exist alone or associated with paralysis and contracture.

Traumatic Hysteria.—This is naught else but hysteria plus the etiology. It follows even minor accidents. Concussion of the body is not essential. A profound mental impression is equally effective. Days or even weeks may succeed the accident or shock before the symptoms develop.

Hysteria long latent and unrecognized may be awakened into obvious activity by a blow or accident (Charcot), and the same observation holds good for epilepsy, according to Pitre. The symptoms may be neurasthenic, hysterical, or a combination of both. Organic lesions rarely follow the traumatic neuroses, yet, as in hysteria, the differential diagnosis from organic lesions is often very difficult. To determine whether a given sensitive area is real or simulated, Mannkopff takes the pulse-rate before, during, and after pressure is made on the area in question. If the pulse becomes increased in frequency, it is a proof that the pain is genuine. In Slora's myasthenic reaction, the affected muscles do not respond by tetanus to faradic stimulation or slowly recover ability to be tetanized. Lowi determined that the dilatation of the pupil was in direct proportion to the intensity of pain. Thus, if in a healthy man one exercises energetic pressure on the testicle, the pupil dilates, whereas in the tabetic, in whom the testicle is insensitive, no pupillary dilatation is observable. Similarly, one may differentiate a pain of psychic or of organic origin in hysteria and traumatic hysteria. Coppioli[268] has studied this sign in a number of cases. He concludes that when the pains are real, the pupil during the paroxysm dilates, and assumes its previous dimensions after the paroxysm has ceased. In pneumonia, pleuritis, appendicitis, etc., pressure on the painful region leads to a pupillary dilatation, whereas in the hysterical subject, when the pains are psychogenic, pressure exercised on the painful area is without effect on the pupil. We have already commented on the value of suggestion in the diagnosis of hysteria and its protean symptoms (page 209).

Arthralgia Psychoneurotica.—In the various neuroses painful joints may often lead to the diagnosis of organic disease. The knee (gonalgia) and hip (coxalgia) are most frequently involved. There is usually an absence of all local inflammatory signs, and the chief symptoms are pain, disturbance of function, and spasm of the muscles contiguous to the joint. On making passive movements of the joints, the pain is described as atrocious, yet, if the patient can be diverted, the same movements may be made without pain. The pain is more intense in the skin and soft parts than in the joints, and between the painful paroxysms areas of hyperalgesia may be demonstrated in the skin over the joints. Analgesia may also be demonstrated. The stigmata of hysteria or the neuroses may be present.

Neurotic Diseases.—There are many hereditary neuroses, but only a few can be mentioned. *Acute chorea* occurs not infrequently in certain families among excitable, nervous children. *Chronic chorea* (Huntington's chorea) is frequently a hereditary disease, but it occurs usually late in life (between the thirtieth and fortieth years). It has been traced through four or five generations.

Diabetes mellitus may attack many members of the same family. Naunyn traced a history of heredity in thirty-five out of two hundred and one private cases. The subjects of this disease are usually of a neurotic temperament. *Diabetes insipidus* is most frequent in young persons, and Weil has shown that of ninety-one members in four generations, twenty-three had polyuria without affecting the condition of well-being. Trousseau observed that the parents of children with this disease were often afflicted with glycosuria or albuminuria.

In *epilepsy* a history of heredity is shown by Gowers in 35 per cent. of his cases. In most instances of epilepsy there is a family neurotic history of hysteria, paralysis, insanity, neuralgia, etc. In the majority of cases the disease begins before puberty, and in attacks occurring for the first time in adult life the suspicion of an organic lesion must always be aroused.

In *insanity* a history of heredity is often elicited. The inheritance is rarely direct. Heredity in mental diseases merely means a defective nervous organization, rendering the psychoneurotic more susceptible to environmental influences and the crises of development. A history of hereditary tendency to mental diseases, remote or immediate, is observed in about 50 per cent. of the cases. The most frequent cause of mental degeneration in the descendant is a history of parental alcholism.

Migraine is often an hereditary affection, attacking chiefly the female members of neurotic families through several generations. The attacks usually cease or diminish in violence at the menopause, and in males after the age of fifty years. When the neurotic history is pronounced, they may persist through life. Mangelsdorf has observed acute dilatation of the stomach during the attacks in practically all of his cases. *Neuralgia* also occurs in individuals with a neurotic constitution, and, as in migraine, more women than men are attacked.

Periodic paralysis is also a familial disease. Many members of a family may be afflicted. The arms or legs are usually involved, and the paralysis occurs during sleep, without evident cause. Sensory symptoms are not usually present. The cerebral nerves and special senses are rarely involved. The faradic excitability of the muscles and nerves is either diminished or absent. Recovery is the rule within a few hours or days. The attacks may recur daily or at intervals of weeks, and usually after the age of fifty years they cease completely. During an attack symptoms of acute cardiac dilatation may be present.

The question of *propinquity* is often obscured by other etiologic factors. Thus, the old question of "cancer houses" has recently been revived by Fillassier and others. In one apartment in a house at Vouziers the husband, wife, father-in-law, and a servant died of cancer between 1870 and 1875. In another house, at Oyonnax, three successive tenants, unknown and unrelated to each other, died within a period of four years. In another case five persons, belonging to three different families, died in a farm-house in the course of forty years. In another house, at Jassy, eight families lived at various times in the course of twenty-five years; in each of these families a case of cancer occurred, and in one there were two cases. The study of Jensen mouse tumor has likewise directed attention to "cancer cages."

Rheumatic Diathesis.—By this is understood a predisposition to rheumatic affections. Osler obtained a history of the disease in the family of 25 per cent. of his cases. Some regard this fact, not as an evidence of heredity, but as a proof of the infectious nature of the affection as a house disease. As in pneumonia, one attack does not grant immunity to other attacks; on the contrary, a predisposition to further attacks is established. Rheumatism is not always frankly expressed with its classic symptoms, and even the masked forms of the disease leave their distinctive marks. The recognition of such stigmata is important in the etiologic diagnosis of many affections which are practically sequelæ of the disease, viz., valvular lesions, chorea (cerebral rheumatism), affections of the joints (ankylosis, dropsy), and atrophy of the muscles when the action of the rheumatic virus is especially pronounced on the muscles and tendons. The conviction is growing that chorea and rheumatism are infectious diseases with a common cause. Chorea occurs most commonly in the spring of the year. *Endocarditis* is the most frequent sequela (25 to 40 per cent.), and its presence as a complication increases in proportion to the number of attacks. Thus, in one hundred and sixteen cases analyzed by Mackenzie, 58.1 per cent. had endocarditis in the first attack, 63 per cent. in the second, and 71 per cent. in the third attack. The tendency to endocarditis diminishes with advancing age. The mitral valve is most frequently involved. *Pericarditis* is at least three times less frequent (Leube) than endocarditis, and effusion occurs in only a small proportion of the cases. *Myocarditis* is the least frequent of the cardiac sequelæ. The presence of *rheumatic nodules* is important in diagnosis. They are subcutaneous nodules, varying in size from a small shot to a large pea, firm and painless, and attached to the periosteum, fasciæ, and tendons of the fingers, wrists, elbow, malleoli, patellæ, vertebral spines, and in other situations. They are more frequent in children than in adults, and they may persist for months after an attack.

Rheumatism in Children.—Owing to our limited conception of rheumatism, many of the manifestations in children are disregarded because they are atypical. Sicard[257] discusses this interesting subject. He observes that the ordinary abrupt involvement with polyarthritis and endocarditis noticed in adults is often replaced in children by chorea, tonsillitis, erythemas, subcutaneous nodules, and endocarditis, which frequently overshadow the joint involvement. The arthralgias in the rheumatism of childhood seldom present the evidence of inflammation seen in the adult. The redness, swelling, and extreme pain are absent, though there is moderate pain on motion. There is tenderness in the periarticular structures. The attacks last a few days or weeks and then subside, but show a tendency to recur. Rheumatism is rare in children under two years of age, and is still more rare in those under one year of age. In most cases of rheumatism in children of two years and over the onset is gradual, the temperature comparatively low, usually not above 102°. There is moderate pain and malaise, and examination reveals a slight puffiness or moderate swelling. The joints most often affected are the knee, ankle, elbow, or wrist, or the small joints of the foot or hand. Sometimes the symptoms are limited to one joint and sometimes they are multiple. In some cases there is a severe restlessness and pain of an indefinite character, but without true rheumatic swelling. Some cases have no fever, and the pain is so slight that the child is not kept in bed. These mild attacks may be overlooked. The temperature may be irregular, leading to the supposition of influenza or malaria, when a minute examination will reveal a sensitive joint, tendon, or muscle; or an endocarditis, chorea, or a persistent anemia is the first intimation of the true nature of the trouble.

Endocarditis is a more frequent complication of rheumatism in childhood than it is in the adult. Pericarditis is more important from a prognostic standpoint, but it is less frequent than disease of the endocardium. Pleurisy may occur during the course or the decline of the rheumatic attack. Not infrequently chorea is a precursor of rheumatism; and the first sequel which appears after the chorea may be endocarditis. A curious and not infrequent lesion is the subcutaneous nodules. They consist of little tumors beneath the skin, free from it, and attached by a pedicle to the tendon-sheaths, ligaments, or the periosteum. They are most frequently found about the elbow-joint, tendon-sheaths of the forearm and hand, the clavicle, sternomastoid muscle, the skull, the patella, the vertebral spines, and the crest of the ilium. They are usually about the size of a pea, though they may be larger, and may occur in groups, as many as fifty having been counted at one time. They are composed of fibrous tissue and may undergo degeneration and disappear in a few weeks, or may remain for months.

Erythema nodosum is the most frequent variety of erythema, though other forms may be observed. The nodes are situated mostly along the tibial regions and the extensor surfaces of the forearm. They are about three-fourths of an inch in length and have their long axes parallel to the limb, are red, raised, inflamed, and exquisitely tender. Upon fading, they leave ecchymotic spots.

Tonsillitis and pharyngitis are closely associated with articular rheumatism, and anemia, if present during the attack, is severe and often acute in its onset. Goodhart observes that in every anemia without cause in children attention should be directed to the possibility of rheumatism. Purpura may occur as a complication, but not as often as in adults.

Scrofulous Diathesis.—The term scrofula is limited to tuberculosis of the lymph-glands. It is probably an attenuated tuberculosis. It is an affection more frequent in children than in adults. The portals of entrance of the bacilli are most frequently carious teeth, the nasal mucosa (in nasopharyngeal catarrh), the tonsils, the respiratory mucosa (measles and pertussis), and the intestinal mucosa when the mesenteric glands are involved. The majority of cases of acute tuberculosis originate from infectious material derived from a latent focus resident in tuberculous glands. Some aver that a tuberculous lymphadenitis in childhood is tantamount to a protective inoculation and protects against tuberculosis in adult life.

Status Lymphaticus (page 61) and **Tuberculous Diathesis** (page 507).

SPECIAL PERIODS.

Childhood.—The skin area is relatively greater in the child than in the adult, and it is more delicate and reacts more easily to external applications and to gastro-intestinal irritation (eruptions). The dietetic treatment of cutaneous lesions is more effective in childhood. Bones are cartilaginous and soft; the cranial bones are thin and soft, and although the fontanels are closed, the sutures are patulous for some years. The spine is soft and flexible, and even at the end of the second year it is perpendicular, and only later is the S-like anteroposterior curvature formed. The thorax becomes relatively broader above than below. The protuberance of the abdomen becomes less owing to pelvic development which admits more of the abdominal viscera. Usually at the end of the second year, or a few months later, eruption of the temporary *teeth* (twenty) is completed and the crowns of all the permanent teeth (except the second and third molars) are calcified. The time of appearance of the permanent teeth begins with the first molar at the sixth year and terminates with the third molars from the eighteenth to the twenty-fifth year. In all, there are thirty-two permanent teeth.

According to Smith, the growing child requires in proportion to its weight about three times as much carbonaceous *food* as the adult and six times as much animal food. Relatively more *urine* is voided than in adults and the proportion of urea is higher. The average quantity of urine at the ages of two to five years is 500 to 800 c.c.; five to eight years, 600 to 1200 c.c.; and eight to fourteen years, 1000 to 1500 c.c. (Holt). The specific gravity and acidity are higher than in adults. Urination is frequent and uncontrollable, but at about the third year the urine may be retained during sleep for about eight hours and during the day for about three hours (Bovaird). In health the ability to retain the urine should increase with advancing years.

Concerning the *nervous system*, the brain and cord are relatively larger than in adults. All the reflexes are more acute in childhood, hence in many diseases at this period of life the nervous system bears the brunt of the symptoms. Thus it is that acute infectious diseases are masked by cerebral symptoms which may suggest meningitis or other cerebral diseases, and it is for this reason also that we hear of the many remarkable (?) recoveries from meningitis. The healthy child during its waking period is never quiet.

Nutrition and development of the body may be determined by reference to the following table, compiled by Bovaird from tables of different authorities (height in centimeters and weight in kilograms):

AGE.	HEIGHT.	WEIGHT.
2 to 3 years	79.1	11.0
3 to 4 "	86.2	12.5
4 to 5 "	92.4	13.8
5 to 6 "	102.8	16.9
6 to 7 "	109.4	19.3
7 to 8 "	115.0	21.4
8 to 9 "	120.4	23.4
9 to 10 years	126.1	25.6
10 to 11 "	129.8	27.6
11 to 12 "	133.9	29.6
12 to 13 "	138.2	32.1
13 to 14 "	142.8	35.2
14 to 15 "	148.5	39.3
15 to 16 "	154.6	45.4

Up to about the twelfth year boys are taller and heavier than girls of a like age, but from the latter age to the fourteenth or fifteenth year the measurements of the girl are greater. The gain in weight and height is noted during early spring and summer, whereas in winter not only is there no gain, but frequently a loss of weight.

Respecting the mental development, the following are noted by Bain: Activity, constant occupation, dislike for continuous application, fond of fun and frolic, curious and inquisitive even to destructiveness, mimetic, imaginative, sociable, sympathetic, strong in memory and weak in judgment. Relative to the development of the child one must not forget the sapient observation of Spencer, "The first requisite to success in life is to be a good animal."

Children usually begin to walk between the tenth and sixteenth months.

Diseases.—*Affections of the mouth* peculiar to children are the various forms of stomatitis. One form, known as thrush or sprue, is caused by the oidium albicans. Another form, known as membranous stomatitis, in which the mouth or nasopharynx is covered by a yellow pseudomembrane, may be diphtheritic or non-diphtheritic. If the diphtheria bacilli are demonstrated by culture, antitoxin is indicated. Bleeding of the gums may be caused by scurvy. A short frenum (tongue-tie) in infants may interfere with sucking, and in older children with articulation. The tongue cannot be protruded as in the norm. Here the frenum is slit downward and backward to avoid injury to the ranine artery lying in the fold of the frenum. Tongue-swallowing may be due to a long or relaxed frenum. Asphyxia may occur during deglutition by the tongue falling back and occluding the glottis. The geographic tongue (map-like patches), due to the desquamation of epithelium, is of parasitic genesis. Riga's disease, caused by the presence of carious teeth, may cause an ulcer on the tongue which is easily cured after attention to the teeth. In pertussis a sublingual ulcer may be detected at a point in the frenum which is in contact with the central incisor teeth. *The Sanford Blum sign* in the diagnosis of acute middle-ear affections is of special value in infants; pressure made by placing the finger behind the angle of the jaw in the groove formed by the inferior maxillary bone and the anterior border of the sternocleidomastoid and pressing upward and inward toward the auditory canal on the suspected side will elicit considerable pain.

Affections of the alimentary canal are frequent. Constipation and straining at stool may be due to errors in diet and fissure at the anus. Colic may be caused by an insignificant umbilical hernia or renal gravel. In cholera infantum we must always suspect milk poisoning. Chronic diarrhea is usually of dyspeptic origin.

Marasmus or infantile atrophy is usually caused by indigestion, but atrophy of the thymus gland is also present in many instances. Tuberculosis and syphilis may also be factors in the etiology.

Rickets usually occurs during the first two years of life. The usual symptoms are: soft and flabby muscles (pseudo-paralysis), late dentition, softened cranial bones (craniotabes), open fontanels, rosary at the ribs, chicken-breast, spinal curvatures, knock-knees, bow-legs, square cranium (caput quadratum), flat-foot, enlarged epiphyses, pot-belly, etc. Rachitic bones yield a faint shadow with the *x*-rays, and this fact is of importance in distinguishing rachitic from other swellings. Rickets is frequent in bottle-fed children in association with defective hygiene.

Scurvy in the vast majority of cases occurs in bottle-fed children, and very rarely in those fed on breast-milk; in all instances it may be traced to the prolonged use of improper food plus intestinal putrefaction. It is more often a disease found among the well-to-do. Nothing produces so rapid a cure as a change of diet, with orange- or lime-juice and possibly beef-juice. Among the symptoms are hemorrhages from any of the mucous membranes (nose, mouth, stomach, genito-urinary tract) and subcutaneous and subperiosteal bleeding causing local intumescences: the gums are spongy and may bleed on being touched; the joints are painful and pain is practically a constant symptom when the child is moved.

Tuberculosis is frequent in children, affecting notably the cerebral meninges, joints, intestines, lymph-glands, peritoneum, etc. Respecting the evidence of tuberculosis in children from an examination of palpable glands in the neck, Lacky and Horton observe that it is exceptional not to meet a child without palpable glands in the neck. They adopt the following scheme:

Glands, readily felt (almonds)	1
Glands (size of filberts)	2
Larger than above	3

Children whose glands are 3, are cases suspicious of tuberculosis, unless some obvious cause is at hand. Bad teeth only indicate the channel of infection, and not the specific infection itself. Thickened scars and old sinuses in connection with glands usually indicate tuberculosis, unless there is a history of a concomitant acute infectious disease.

Bronchitis may occur as an independent affection or it may be the initial manifestation of many infections (pertussis, measles) peculiar to childhood.

Persistent *coughs*, especially of a croupy character, may be caused by enlarged tonsils, adenoids, granular pharyngitis, or nasopharyngeal catarrh. A loud, barking cough (*cynobex hebetica*) occurs in children about the time of puberty, notably in boys with a neuropathic constitution. After influenza a false whooping-cough may be present which yields promptly after local treatment of the pharynx. Spasmodic coughs plus dyspnea demand an examination of the thymus and bronchial glands, which may be enlarged.

When an *acute lobar pneumonia* begins with convulsions, it indicates a severe form of the affection, but if the convulsions occur at the time of resolution, a meningeal complication is suspected and the prognosis is bad. Instead of pain being localized in the chest it may be limited to the abdomen, and, taken in connection with tympanites, the clinical picture may counterfeit appendicitis. The apex of the lung is more frequently involved than in adults, and the cerebral symptoms are more pronounced. Pneumonic sputum is rarely found. Children usually swallow their sputa. In instances where the sputum is necessary in diagnosis, the child's stomach may be washed or vomiting induced. In other instances inspection of the throat may reveal some of the sputum adherent to the pharyngeal mucosa. In children who furnish a scanty expectoration the sputum may be swabbed from the throat or obtained from the stomach or feces and examined according to the method of Strasburger; mixing with water, sedimenting, mixing the top layer with three or four parts of 95 per cent. alcohol, centrifuging, and straining the sediment in the usual way.

If a child has capillary bronchitis, *bronchopneumonia* as a complication may be positively diagnosticated, even in the absence of marked physical signs, if the fever rises to 103½° F. and above;

the temperature in capillary bronchitis, although increased in contrast to other forms of bronchitis, only exceptionally reaches 103° F., and usually remains at 102° F. (Leube).

About one-third of all *pleuritic effusions* in children are of the nature of pus or sero-pus (Caillé). One must not forget that diphtheria may be limited to the nasal mucosa, and it may persist for weeks (larvated form) with no manifestations beyond the local symptoms of nasal discharge.

Glandular fever is characterized by a slight pharyngitis, high fever of short duration, and swelling of the cervical lymph-glands. The prognosis is favorable. The swelling of the glands subsides usually in about three weeks, although they occasionally suppurate.

It is often necessary to distinguish true from false *croup.* The former, also called membranous, is practically a laryngeal diphtheria, although it may be diphtheroid (streptococci only found) in a very small percentage of cases. In the primary form of true croup the pharynx and temperature are normal, and the symptoms (hoarseness, aphonia, dyspnea) come on gradually and steadily increase in severity, whereas in the false form (spasmodic) the child may have slight catarrhal symptoms (laryngitis) with cough and hoarseness during the day, and at night croupy symptoms develop, or the latter may be absent and symptoms (difficult breathing, huskiness of voice, and croupy cough) occur suddenly at night. The child in the morning is usually well, but the attacks may be repeated for several nights in succession. If there is any laryngeal edema inducing the attacks, a spray of adrenalin may be used. It is practically impossible in most instances to make local applications, but by spraying during inspiration some of the preparation will be carried down and into the larynx.

Dyspnea may be caused by a *retropharyngeal abscess*, usually emanating from suppurating lymph-nodes. Associated signs are dysphagia, restlessness, and a nasal cry (*voix de canard*). A projecting intumescence can be seen or felt on the posterior pharyngeal wall. The abscess is also secondary to caries of the cervical vertebræ, diphtheria, scarlatina, and other infectious diseases.

Angina Ludovici is a streptococcus infection originating usually in the mouth in the submaxillary region of one side and extending to the soft tissues of the neck (cellulitis). It may be idiopathic, but is usually secondary to specific fevers (diphtheria, scarlatina). The symptoms are local (edema of the glottis, dysphagia, suppuration) and constitutional (infection).

From twelve hours to five days before the cutaneous eruption in *measles*, small red spots (Koplik spots) with a minute blue or bluish-white center appear on the inner surface of the cheeks, corresponding to a point at the line of junction of the molars when the jaws are in apposition. These prodromal buccal maculæ are practically constant (six-sevenths of all cases, according to Huebner). The spots in question must not be confounded with an eruption which sometimes occurs over the entire buccal mucosa, which is an enanthema corresponding to the exanthema. The pre-eruptive fever may show a remission to normal or subnormal in measles (Caillé).

In *scarlatina* McCollom emphasizes the importance of finding a punctate eruption in the arm-pits, groins, and on the roof of the mouth as pathognomonic.

Varioloid is an attenuated variola occurring in a person who has been vaccinated. The *fourth disease* (Dukes) is manifested by a scarlatiniform eruption which covers the body in a few hours and may avoid the face. *Erythema infectiosum* is a mild epidemic exanthema presenting a morbilliform eruption on the extremities, notably the extensor surfaces, and the trunk, as a rule, is not invaded.

Malaria in children, if intermittent, is usually of the quotidian or tertian type. Chills are less evident and the spleen is not frequently enlarged. In the chronic form anemia and an enlarged spleen and liver may suggest an examination of the blood or the application of the therapeutic test with quinin.

Typhoid fever usually pursues a mild course and complications are rare. Certain sequelæ (bone-lesions, noma, aphasia) are said to occur more frequently in children than in adults.

Convulsions may be due to a variety of causes (gastro-intestinal disturbances, peripheral irritation, brain-congestion, as in pertussis). Rickets is a frequent cause, and here the spasms are laryngeal. A convulsion is often the initial symptom in infectious diseases. Infantile hemiplegia is preceded in a large percentage of cases by a convulsion. Convulsions in children may be veritable attacks of epilepsy.

TABLE OF THE ERUPTIVE FEVERS.

	Measles (Rubeola).	Scarlet Fever (Scarlatina).	Rubella (German Measles).	Varicella (Chicken-pox).	Variola (Smallpox).
Incubation...........	Seven to eighteen, but usually fourteen days.	One to seven, but usually three days.	Fourteen to twenty-one days.	Ten to fifteen days.	Seven to twelve days.
Invasion.............	Three to four days with symptoms of a feverish cold.	Sudden, but may be preceded by indisposition.	Head and backache, coryza.	Chilly sensations and slight fever.	Severe pains in the back and limbs, headache, and emesis.
Eruption.............	On the fourth day flea-bite spots on the forehead and face and extending downward to the legs. Rash is irregularly blotchy, but not diffused.	On the second day as red points, but spread rapidly over the entire skin. The erythema has a vivid scarlet hue.	On the first or second day on the face, then chest, and finally over the body. Discrete or confluent papules of a rose-red color.	In a few hours, first on the trunk as raised red papules, which become vesicles in a few hours, and in about forty hours purulent; which are discrete.	On the fourth day macules on the forehead, and within twenty-four hours extension all over body. Macules change into papules, vesicles, and pustules. Papules have a hard shotty-feeling.
Symptoms...........	Coryza, conjunctivitis, and cough.	Flushed face, intense fever, strawberry tongue, angina.	Slight fever and early swelling of the cervical lymphatic glands.	Mild constitutional symptoms.	Severe constitutional symptoms.
Complications........	Bronchitis and broncho-pneumonia.	Nephritis, arthritis, heart and ear complications.	Rare. Occasionally in severe cases nephritis and pneumonia.	In delicate children gangrene may occur around the vesicles.	Laryngitis, broncho-pneumonia, eye and ear complications.

Night and day terrors (*pavor nocturnus et diurnus*) may be caused by nasal obstruction or indigestion. In other instances emotional causes acting on a neuropathic constitution are operative. *Tetany* in children may be caused by an acute infectious disease, gastro-intestinal disturbances, and rickets. In rickets one encounters not infrequently *carpopedal spasm*, which is not true tetany. As the name suggests, the spasms are limited to the hands and feet, and are of a transient nature.

Among the paralyses of infancy and childhood are the following:

1. *Obstetrical paralysis*, caused usually either by the forceps or by prolonged pressure on the maternal parts. In the form caused by drawing apart of the head and shoulder, the brachial plexus may be partially or completely ruptured.

2. *Infantile paralysis* (acute anterior poliomyelitis). This occurs usually between the ages of one and four years, and is manifested by sudden onset with fever, vomiting, diarrhea, etc., and followed by motor paralysis and rapid atrophy. The cause is unknown and children in apparent health are attacked. Epidemics of the disease have been observed. The affection attacks more boys than girls and more cases are reported during the warm months. The paralysis is distributed irregularly; one or both arms, or one arm and one leg, or both legs, or right leg and left arm may be affected. The rapid atrophy of the muscles, the reaction of degeneration, and the loss of the reflexes are characteristic of this affection and serve to distinguish it from the cerebral paralyses.

3. *Spastic paralysis of infants* (Little's disease). A disease manifested by spasm and paralysis of all the extremities, notably the legs, without wasting, loss of reflexes or of sensation. The subjects show mental impairment. The disease commences at birth and is attributed to injuries received during delivery. The rigidity of the legs and arms may not be noted until the child commences to walk. Associated symptoms are irregular muscular movements (*chorea spastica*) and bilateral athetosis in which there are involuntary and rhythmic movements of the fingers and toes and more rarely of the facial muscles.

4. *Infantile spastic paraplegia.* A spastic paralysis of the legs dating from birth or occurring within the first few years of life without wasting of the muscles.

5. *Hemiplegia.* The majority of cases are observed during the first two years. The etiology is associated with infectious diseases, difficult labor, and traumatism. In the majority of cases the attack is preceded by convulsions and unconsciousness lasting for hours or days. On return to consciousness, a hemiplegia is observed involving the right more often than the left side, and the face is usually not involved. Either the paralysis may disappear or partial recovery occurs. Among the sequelæ are rigidity, aphasia, epilepsy, mental impairment, and post-hemiplegic movements, which may consist of tremor, choreiform movements, or athetosis.

6. *Amaurotic family idiocy* (Sachs' disease). This is characterized by flaccid or spastic paralysis of the extremities, partial or total blindness (optic nerve atrophy), and psychic disturbances progressing to idiocy. Of the twenty-seven cases analyzed by Sachs, seventeen occurred in six families (all Jews). Death usually occurs from marasmus before the second year.

7. *Muscular dystrophies.* They are characterized by muscular wasting of a progressive character in which the primary changes are resident in the muscles. There is a pronounced history of heredity and many members of the same family may be attacked or may be afflicted through several generations. The disease usually commences before puberty, and in rare instances not until the age of twenty years or later. The forms of the disease may be divided into two main groups: Hypertrophic (pseudo-hypertrophic muscular paralysis) and atrophic forms. The prognosis is bad.

8. *Pseudoparalysis.* Rachitic, scorbutic, and syphilitic children may show muscular weakness which simulates paralysis. In such instances the feeble musculature and the pain associated with movements are responsible for the pseudoparesis.

Cretinism.—Associated with loss of function of the thyroid gland, nutritional disturbances follow known as cretinism, which may be sporadic or endemic. Not before the infant has attained the age of seven months is the condition usually recognized. The infant presents the following physiognomy: the tongue protrudes from the mouth owing to its increased size, the skin is thin and dry, the face is bloated and the nose is flat, the abdomen is protuberant, the legs are thick and short, the fontanels remain open, dentition is delayed, and the mentality of the subject is akin to idiocy or imbecility. The employment of thyroid preparations (page 349) is diagnostic.

Puberty.—At this period the evolution of the sexual apparatus and development of reproductive power give rise to new sensations and strong emotions. The mind, especially of the boy, becomes charged with emotional, sentimental, amatory, and fantastic imaginings, and vicious habits are formed. The average age of puberty in the male is about fourteen years and in the female about 13.7 years. Suggestion, the reading of erotic literature, and an early social life hasten puberty. The physical changes incident to this period are well known and psychic changes are equally pronounced. Puberty is the most vulnerable period of life for the mental stability of either sex. This does not necessarily mean that outbreaks of insanity are more frequent at this period, but signifies the avoidance of sexual, alcoholic, and social factors which later contribute to mental instability. The pubescent insane are usually the victims of inherited predisposition. A frequent form of insanity at this period is the alternating type, in which there are periods of excitement, periods of depression, and periods of composure and complete lucidity. Fairbanks, Renaut, and others refer to many cases of *cardiac insufficiency* noted in girls and boys. Among the subjective signs are: pain in the precordial region and very frequently in the hypochondrium or abdomen, even after moderate exercise, associated with cyanosis and dyspnea. The objective examination of the heart is often negative, although irregularities in the rhythm, murmurs, and extension of the cardiac dullness may be noted. Absolute rest in bed, saline baths, and graduated exercises are essential in treatment. Schieffer[367] has shown that diet exercises an important influence on the nutrition of the heart and consequently modifies its functional capacity. Thus diminished nutrition will reduce the volume of the heart-musculature and forced feeding will restore its normal dimensions and vigor.

Menstruation.—The physical changes incident to the commencement of this function are: swelling of the breasts, pelvic widening, enlargement of the thighs, and the appearance of hair upon the pubes. Among the psychic changes are: the assertion of individuality which brings with it the desire for change and to accomplish something, the creation of doubt, and emotional and sentimental ideas. Menstruation is a periodic discharge of blood from the uterus and Fallopian tubes, and takes place every twenty-eight or thirty days. Prior to its occurrence (several months) there is a monthly swelling and tenderness of the breasts, lassitude, headache, and an occasional white mucous discharge. The symptoms preceding the established menstrual flow are essentially nervous, and usually cease or are relieved by the beginning of the flow. In other instances menstruation, by exalting the excitability of the nervous system, gives rise to all kinds of nervous symptoms (headaches, neuralgias, mental depression, hysterical and epileptic attacks). At this period there is a tendency to abnormal pigmentation about the eyes and upon the face and the occurrence of acne. In determining whether the menstrual flow is excessive (an etiologic factor in anemia), it is well to remember that the use of more than three napkins a day indicates that the discharge is excessive. The flow usually lasts from three to six days. It is often necessary to determine whether an excessive loss of blood (menorrhagia) is responsible for certain post-menstrual symptoms. If the latter respond to measures having for their object inhibition of an excessive loss of blood (rest in bed and the use of *calcium chlorid*), the anemic nature of the symptoms may be established. In severe cases it may even be necessary to plug the uterine canal during menstruation and thus arrest the flow mechanically. If the symptoms are nervous, the use of bromids or other sedatives during menstruation may be indicated, and the patient may even be subjected to all the restrictions of a rest-cure during the periods. I have found the latter method very efficacious among my nervous patients, in whom eternal vigilance is the price of health, and especially so when the influences of civilization have converted a physiologic into a pathologic function.

Menopause.—The cessation of the menstrual flow marks an important epoch in the life of woman, and it is a veritable change of life, occurring usually between the ages of forty and forty-five years. Its occurrence before the age of forty indicates that it is premature; and later than the fifty-fifth year, that it is retarded. Among the causes of a premature menopause are: extremes in temperature (in the tropics the menopause may occur between the ages of twenty and thirty and in the arctic regions between thirty and forty), conditions which impair the general health (tuberculosis, syphilis, anemia), excessive obesity, surgical operations (removal of the ovaries is followed in 90 per cent. of the cases by an immediate arrest of menstruation), and excessive fertility (bearing children in rapid succession). It is retarded in fibroid tumors of the uterus and in malignant diseases of the genital organs.

Symptoms.—The flow may either cease abruptly or it may occur irregularly for several years before ceasing entirely, and its irregular recurrence may be associated with an excessive loss of blood. In the latter instance the condition of the uterine mucosa demands the use of the curet or other active treatment. Vasomotor disturbances (flushing, fullness in the head, roaring in the ears, pallor, and chills) are frequent at the time of the menopause and may persist until the end of life. Among the mental and nervous phenomena are: headaches, neuralgias, insomnia, and hysterical symptoms. Berkley regards the menopause as the most critical period of the mental life, and not less than 19.8 per cent. out of 23,772 insane women are victims at this period. The immediate factors of insanity at the menopause are menorrhagias and leukorrheas, which induce anemia and general depravity of the system. Nutrition at the menopause is defective, hence there are muscular degenerations, fat accumulations, a tendency to the formation of malignant growths, and functional and organic disturbances in various organs of the body. Impregnation may occur after the menstrual flow has ceased, and Andrew F. Currier has observed not only instances of this kind, but knows of pregnancy having occurred even when both ovaries have been removed. In the latter instance it is possible that either the ovaries were not entirely removed or there may have been a supernumerary ovary. One must always remember that when symptoms during the menopause exceed mere vasomotor phenomena, and especially when there are definite signs of pelvic origin, search must be made for some local lesion which provokes the symptoms.

Marriage.—The influence of consanguineous marriages upon offspring may be with or without ill effect. On the one side, Guipon gives expression to the following: "Consanguinity exerts a depressing effect on the vital forces, notably upon reproduction, so that if sterility is not observed in consanguineous marriages themselves, it at least shows itself in the children. It affects the functions of relation and the organs of sense, hearing, speech, and sight. The genital sense is exalted, but its natural end and aim is thwarted." On the other side, Voisin observes that as a result of a careful examination of 1077 of his patients at the Bicêtre and Salpêtrière hospitals, in no one instance of his idiotic, epileptic, or insane patients could healthy consanguinity be legitimately regarded as the cause of the affection. A study of the literature bearing on this subject prompts one to conclude that consanguineous marriages accentuate morbid characteristics of parents and perpetuate mental and physical peculiarities of families.

In *hemophilia* it is known that the daughters of a bleeder, although showing no manifestations of the affection, are nevertheless certain to transmit the hemorrhagic diathesis to the male offspring, hence the daughters of a bleeder's family should not marry.

In *tuberculosis* where the lesions have been elsewhere (bone and lymph-glands) than in the lungs and have healed, there is no reason why marriage should be interdicted, although one cannot deny that the hereditary soil has been transmitted, and that the children of such marriages are predisposed to tuberculous affections. In healed lung tuberculosis the danger is unquestionably greater, especially with the woman, should pregnancy ensue. In any event a tuberculous subject by marrying assumes a great responsibility. Dubois observes: "If a woman threatened with phthisis marries, she may bear the first accouchement well; a second, with difficulty; a third, never." There is a decided tendency of late to attach more importance to infectivity than to hereditary transmission in tuberculosis. Scientifically speaking, direct transmission is unquestionably rare, but no one denies that the offspring of consumptive ascendants inherits a constitution that lacks physical resistance and is a susceptible field for infection. Thus it is that our modern conception of transmission does not mitigate the importance of the so-called "family taint." Some writers estimate that a family history of consumption may be elicited in 50 per cent. of consumptives.

Gonorrhea.—Noeggerath, in 1872, enunciated his doctrine of latent gonorrhea, which embodied the essential fact that gonorrhea, though apparently cured, may exist in a latent form in both sexes throughout an entire lifetime. He endeavored to show that in every man, with few exceptions, who had contracted gonorrhea, the disease persisted in a latent form, and that at the time of his marriage the disease is transmitted to the wife, where it may likewise persist in a latent form. Latent gonorrhea in the woman is the cause of many troubles generalized by the designations periuterine and pelvic inflammation. The recognition of latent gonorrhea in both sexes is very important in etiology. Gonorrhea in the female may be acute or subacute. The lesion may be located and limited to the vulva, urethra, vagina, or the cervix uteri. Some contend that the cervix uteri may be the primary seat of all gonorrheal inflammation. The acute form, by its fulminating symptoms, rarely escapes recognition. Involvement of the urethra (scalding in micturition) is now no longer regarded as absolutely diagnostic. There is only one way of establishing an absolute diagnosis, and that is, by the demonstration of the gonococcus in the secretions of the vagina, urethra, or cervix. From the latter situation sufficient secretion may be obtained on a cotton swab rotated within the cervical canal, and from the urethra by milking it with the finger from the neck of the bladder to the meatus. In man one should make the various tests of cure (page 264). It is best to practise stripping the urethra before the patient has urinated in the morning, and then to submit the secretions to microscopic examination and culture. By centrifuging even an apparently clear urine a sediment may be obtained for microscopic examination and culture. Secretions may also be obtained on the shoulder of the *bougie-à-boule.*

Syphilis.—It is the consensus of opinion among syphilologists that syphilitics may marry with safety if two years have elapsed since the date of infection and if there have been no manifestations of the disease for at least a year. The danger to wife and offspring diminishes year by year. The more conservative syphilologists advise that the physician should assume no responsibility in this respect, and to assure the patient that we have no means of determining when the patient is permanently cured of his disease. It appears to me that the latter attitude is unjust, insomuch as we are dealing with the question of transmission and not with the question of cure. We no longer submit to the pessimistic doctrine that once syphilitic, always syphilitic; on the contrary, we regard syphilis as curable if the subject has been properly treated during the active stages of his disease. To make assurance doubly sure, every individual should receive annually a brief course of treatment with mercury and the iodids. . Adults with inherited syphilis should submit to antisyphilitic treatment before they beget or conceive children. When both parents are syphilitic, conception must be avoided for at least six years after inoculation, during which time they should submit to antisyphilitic medication.

Propinquity.—The intimate contact between man and wife is of unquestionable influence in the etiology of disease. Thus the investigating committee of the British Medical Association sought to determine the question of contagion between man and wife in *tuberculosis;* two hundred and sixty-one replies were received in the affirmative, among which were one hundred and fifty-eight instances of presumable contagion through marriage. Among the cases of Weber, one of his patients lost four wives in succession, one lost three, and four lost two each. In *diabetes mellitus* the disease may exist at the same time in man and wife, and Schmidt employs this fact as evidence of the contagious nature of the disease. Among his 2320 cases, twenty-six cases were observed as the result of contagion, and in the majority of the instances the wife became afflicted later than the husband. Many cases have been reported of *locomotor ataxia* coexisting in man and wife, and a few instances where the children have been similarly afflicted. *General paralysis* (paresis) has been observed at the same time in husband and wife, and not infrequently one has tabes and the other paresis. *Psychic infection* is responsible for many neuroses coexisting in husband and wife and among other members of the same family. As an endemic or even family neurosis may be mentioned the condition known as saltatory spasm. Here the subjects after an emotion will jump violently, and utter loud cries and obey any command or imitate any action. A like neurosis exists in Russia (myriachit) and Java (latah), and the subject mimics everything that is seen or heard. This condition is somewhat similar to that known as echolalia, observed in children, in which the subject makes in-articulate cries and words are mimicked again and again, accompanied with involuntary movements. *Folie-à-deux* refers to a mental disturbance in two or more individuals closely associated. In this condition the psychosis may typify nearly all the varieties of insanity. Among the factors operative in this communicated alienation are hereditary predisposition, intimate association, and a morbid environment conducing to emotional shocks.

Pregnancy.—Among the physiologic modifications of this period are the pressure-symptoms of the enlarged uterus, conducing to functional disturbances of the rectum and bladder, interference with the return of the venous blood (varices of the vulva, rectum, and lower extremities), interference with respiration on exertion, distention and separation of the recti muscles, and protrusion of the navel. The quantity of blood is increased, notably the watery constituents, and the pulse shows increased tension. Nausea and vomiting are frequent symptoms during the first three months. Pigmentation of the skin occurs, especially of the areola and the face, and a pigmented line running from the navel to the symphysis is a frequent phenomenon. There is an increased irritability of the nervous system.

Diagnosis.—The diagnosis of pregnancy is based on many signs. Absence of menstruation is an important sign, provided the woman has been regular and there are no constitutional symptoms which may account for the amenorrhea. Morning sickness is a sign of some value, provided other reflex causes can be eliminated. The sensations imparted to the mother by the fetal movements (quickening) are influenced by suggestion. It is impossible to make a positive diagnosis of pregnancy before the sixth week, insomuch as enlargement of the abdomen, breast, and the foregoing signs may be due to uterine disease, especially a tumor, but in addition to the signs already mentioned, pregnancy may be assumed to exist if the uterus is of a doughy consistency, if the cervix is softened, and an angle is noted between the cervix and the body of the uterus. The absolute signs are derived from the fetus (heart-sounds, ballottement, and fetal movements), but they are comparatively late phenomena of gestation. Among other signs of early pregnancy are the following:

1. Jacquemien's sign, which consists of a violet hue of the

vagina at a spot just below the urethra. It is present after the sixth week.

2. Blush of the cervix.

3. Eccentric hypertrophy of the cervix.

4. Slight enlargement of the thyroid.

5. Excitability of the heart and nasal mucosa in neurotic women.

6. Softening in the lower uterine segment with enlargement of the uterine body (Hegar's sign). This sign is not of much value before the twelfth week. To elicit this sign the forefinger is inserted far into the rectum and the thumb into the vagina, while the uterus is pressed down by the other hand applied upon the abdominal wall. This sign is not certain, insomuch as it is not invariable in pregnancy and may be appreciated in a non-pregnant uterus softened by congestion or inflammation.

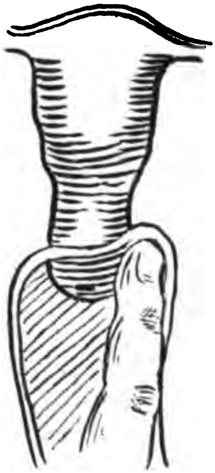

Fig. 112.—The shape and size of the non-pregnant uterus.

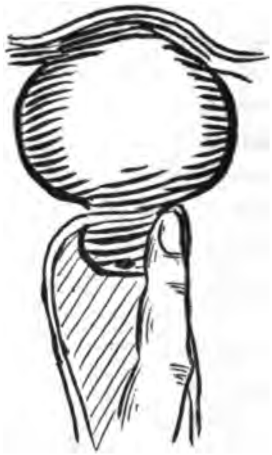

Fig. 113. The shape and size of the uterus altered by early pregnancy.

7. A jug-shaped uterus.

8. Sign of Ladinski.[295] The latter sign has been reported recently, and is regarded by the author as equally as reliable as any of the positive signs of advanced pregnancy. The sign refers to a change in the consistency in the body of the uterus. Frequently as early as the fifth week, but always in the sixth week, there can be felt in the

median line in the anterior wall of the body of the uterus, just above the junction of the body and cervix,—in other words, in the isthmus of the uterus,—a circular area the size of the tip of the finger, which presents to the palpating finger the sensation of an elastic fluctuation. As pregnancy advances this area increases in size in a crescentic manner, until between the third and fourth months, when nearly the entire anterior body, with the exception of the upper crescent of the fundus, partakes of this change, and gives the cystic, fluctuating feel to the examining finger. The change appears in the anterior wall of the uterus when the uterus is in the normal position or slightly anteverted, but in extremely retroverted or retroflexed uteri the elastic area appears in the posterior wall, but instead of being perceptible in the fifth or sixth week of pregnancy, is usually felt in the sixth or seventh week. In incomplete abortion or subinvolution there is a change in the consistency of a similar area of the uterine wall, but while in pregnancy the feel of this area is distinctly elastic or cystic, the sensation obtained in subinvolution and incomplete abortion is very soft and doughy. The two conditions can very readily be differentiated. A familiarity with this sign of pregnancy will enable one to determine with a fair degree of certainty whether an abortion is threatened, inevitable, or incomplete. In cases of early pregnancy with symptoms of threatened abortion the area above referred to remains cystic and elastic so long as the ovum is viable, but becomes soft, doughy, and compressible when the ovum dies, and the abortion is inevitable. The sign is obtained by bimanual palpation. While the external hand fixes the uterus by counterpressure, and the anterior wall of the uterus from the cervix to the fundus is palpated with the internal finger or fingers, the elastic area in the body of the uterus, immediately above the cervix, will be readily made out; the size of the area will correspond with the duration of pregnancy.

9. Ballottement is an excellent sign. The womb becomes spherical in outline, softer in consistency, and enlarged. There is marked anteflexion on account of the weight of the body of the uterus and the softening of the lower uterine segment. With one hand over the fundus and the fingers of the other hand in the vagina an impulse may be conveyed by the latter to the uterine contents, which are displaced upward, communicating an impact to the

external hand and falling again into its original situation; a tap is felt upon the uterine and vaginal walls by the fingers applied internally (Hirst).

According to many obstetricians a diagnosis of pregnancy is often only presumptive until the fetal sounds can be heard and the fetal movements felt. The fetal heart-beats are not heard until the fifth month. The fetal heart averages 120 to 160 beats a minute. The beat is a double one, and the sound has been compared to the ticking of a watch under a pillow. The absence of the fetal heart-sounds does not exclude pregnancy: the child may be dead, the quantity of liquor amnii may be excessive, thickened abdominal walls and certain positions of the fetus may prevent auscultation of the sounds.

Clinical Pathology.—The augmented metabolism during gestation puts an additional burden on the functions of the excretory organs, and if the latter are unequal to the emergency, the products of retrograde metamorphosis may accumulate, leading to the condition known as **toxemia** of pregnancy. In many instances the liver as a transforming organ is at fault (hepato-toxemia). It is claimed that by testing the hepatic functions (*vide* liver, in the chapter on diagnosis of visceral sufficiency) one is not only able to diagnose, but to anticipate, the auto-intoxication of pregnancy. Among the symptoms of toxemia are: headache, dizziness, disturbances of vision, vomiting, and diarrhea. The urine shows diminished elimination of urea, but the important point to determine is the quantity of urine excreted, for, as Jewett has shown, eclampsia rarely occurs when the daily amount of urine exceeds three pints, and that a large amount of urine will excrete the toxins even though the tests demonstrate a reduced excretion of urea. Albuminuria occurs during the latter months of normal pregnancy in about 5 per cent. of the cases. Jewett shows that albuminuria is present in about 85 per cent. of eclamptic patients prior to the first convulsion. The hyperemesis of pregnancy, and even the ordinary vomiting, have been attributed to auto-intoxication. In all instances when one has reason to suspect that toxemia is the etiologic factor of the symptoms during gestation, one line of action is imperative—diminish waste by a simplified diet, preferably milk exclusively, and hasten elimination by salines, the free ingestion of water, and an abundance of fresh air. Mental disturbances occur more frequently after labor than during pregnancy, and 80 per cent. of the cases of insanity among women are said to be directly or indirectly associated with the pregnant state. Insanity is generally without effect upon the course of the pregnancy, but the children are often born dead or die soon after delivery. Edema of the lower extremities occurring during gestation is supposed to be an infrequent concomitant of toxemia. The question of *heart disease* and pregnancy has been variously interpreted, some claiming that the complication is one of gravity, whereas others contend that it is easily influenced by early and appropriate treatment. Tuszkai[256] divides the cases in the relation to prognosis into the following classes:

1. Those cases in which the cardiac lesion was present before the woman became pregnant. Here the prognosis is, in general, very bad.

2. Those cases in which the disease of the heart, previously in a latent state, has been awakened to activity by the pregnancy. Women suffering from an angiosclerosis, or those who have been afflicted with any of the infectious diseases shortly before the pregnancy began, are particularly liable to the complication noted. The diagnosis in these cases will be simplified by a knowledge of such a previous disease and the fact that the cardiac symptoms developed only during the latter months of pregnancy. The prognosis in this class of cases depends entirely on the severity and character of the original disease, being either very good or very bad.

3. Those cases which present cardiac lesions peculiar to pregnancy. If the other two classes can be excluded, the diagnosis is not difficult. In this class belong the slighter forms of heart trouble, which are essentially of a functional character, and therefore furnish a favorable prognosis, the disease usually subsiding promptly after delivery.

Puerperium.—Puerperal infection is the most important and serious accident of this period, and is essentially wound infection. Insomuch as the normal uterine cavity is generally regarded as sterile, the infection comes from without. The symptoms correspond to those of wound infection plus various grades of septicemia, viz., chills, fever, headache, malaise, delirium, tenderness on pressure of the lower abdomen, change in the character of the lochia, etc. In the milder cases where infection is limited to the endometrium, the symptoms rapidly subside after the uterus is washed out or after the removal of necrotic material. When the infection has extended and is not limited to the endometrium, the uterine surface is smooth and there is only a scanty purulent discharge and the general symptoms are out of all proportion to the minor local manifestations. Before the diagnosis of puerperal fever is definitely established, one must remember that pyrexia may occur during the puerperium and may be caused by diseases other than infection, and, further, that during the first thirty-six hours a slight pyrexia (rarely over 101° F.) may be caused by the absorption of blood-clots and sterile exudates.

Lactation.—The secretion of milk which is normal in pregnancy also occurs in pseudocyesis and in tumors of the uterus and ovaries. It is also noted very often in male and female children during the first weeks of life. The milk may be secreted from nine to sixteen months, but it may be prolonged even beyond this time, provided the child is allowed to nurse. Defective lactation may be caused by mechanical interference with the escape of the milk or from undeveloped glands or nipples. Hard nipples may be softened by massage and the application of some aseptic oil or ointment. The nipple may be drawn out with the breast-pump or a clay pipe. The best stimulus to the flow of milk is the sucking of the child, and as a substitute, the breast-pump. Defective lactation may be caused by plethora, which is benefited by a regulated diet and the avoidance of stimulants. Thyroid extract is a galactagog and improves the nutritive quality of the milk. Torpor of the mammæ may be benefited by the local application of electricity, warm poultices, massage, or the use of the breast-pump. Among the drugs which possess a galactagog action are jaborandi and physostigmin; their action, however, is temporary. The malt preparations increase the quantity but deteriorate the quality of the milk. The volatile oils (oil of anise) give a pleasant flavor to the milk, and in this way the child may be induced to take the breast. If the mother is anemic, iron, tonics, good food, and exercise must be prescribed. Among the conditions which contraindicate suckling by the mother are: tuberculosis, infectious diseases (typhoid, erysipelas, etc.), mastitis, and malignant tumors of the breast.

Senility.—From a biologic standpoint this period dates from the decline of the reproductive function, and begins in women at the menopause and in men at about the fortieth year. "Longevity," as Osler puts it, "is a vascular question," and "a man is only as old as his arteries." Change in the arteries (arteriosclerosis) is one of the most constant and earliest manifestations of old age, which may begin very early in life. The heart is frequently small and shows signs of brown atrophy and the coronary arteries are sclerotic. The costal cartilages become ossified and show less mobility; the respiratory surface is diminished and a senile emphysema occurs, owing to atrophy of the alveolar walls. The glands of the digestive tract atrophy and degenerate; the musculature of the stomach and intestines shows diminished tone, resulting in dilatation of the organs. The kidneys become atrophied and the arteries are atheromatous, hence there is a diminished excretion of urine and the organs are less fitted to eliminate waste products. Hypertrophy of the prostate occurs, according to Seidel, in 16 to 22 per cent. of old men and atrophy is equally frequent. The bladder musculature is atrophic, leading to passive dilatation of that organ. Among the diseases common to old age are: pruritus, carcinoma, prostatic hypertrophy, gout, cataract, myocarditis, aneurism, angina pectoris, cerebral apoplexy, paralysis agitans, and pneumonia; the latter may be so slight as to escape detection, for, as a rule, the constitutional are out of all proportion to the local symptoms.

CHAPTER VI.

THE DIAGNOSIS OF VISCERAL SUFFICIENCY.

The Circulatory System.—The Heart and the Blood-vessels.—The Respiratory Apparatus.—The Glandular Organs.—Suprarenal Glands.—Thymus Gland, Thyroid Gland.—The Liver.—The Kidney.—Mammary Gland.—The Pancreas.—The Stomach.—The Intestines.—The Blood.—The Nervous System: Brain, Spinal Cord, and Peripheral Nerves.—Muscular Sufficiency.—Test of Condition.—The Foot.—Pelvic Sufficiency.

THE CIRCULATORY SYSTEM.

THE HEART.

Physiology.—The series of alternate changes in the heart is known as the cardiac cycle (Fig. 114); the latter consists of contraction (systole) and relaxation (diastole). The contraction of the auricles (auricular systole) occurs simultaneously, and is followed by contraction of the ventricles (ventricular systole); then follow relaxation and repose of the heart (diastole), after which the cycle is renewed with auricular systole. The cycle, with an average pulse (72), lasts 0.8 second: auricular systole, 0.1 second; ventricular systole, 0.3 second; and diastole or repose, 0.4 second. When the heart is accelerated, the time of each cycle is diminished, and such diminution is at the expense of diastole. During auricular diastole blood is received from the large veins into the auricles, and with auricular systole this blood is poured into the ventricles; with ventricular systole each ventricle forces about 3 ounces of blood into the aorta and pulmonary artery. The left contracts with more force than the right ventricle, because the walls are thicker and because it must overcome the resistance of the small vessels throughout the body, whereas the pulmonary artery is only opposed by the resistance of the pulmonary vessels. The *valves* are: (1) Auriculoventricular (mitral and tricuspid), which are open during auricular systole and close when the ventricular blood-pressure is augmented; thus the blood cannot regurgitate into the auricles, but must pass on to the pulmonary artery on the right and into the aorta from the left ventricle. (2) Semilunar (aortic and pulmonary), which are open as long as the ventricular exceeds the aortic pressure, but after ventricular systole the blood flows back and fills the pockets of the semilunar valves, closing them and thus preventing regurgitation into the ventricles.

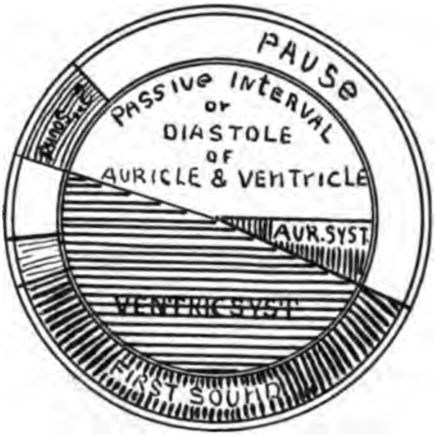

Fig. 114 —Scheme of cardiac cycle. The inner circle shows the events which occur within the heart; the outer the relation of the sounds and pauses to these events.

Heart-sounds.—At any point over the heart two sounds are heard, corresponding to each heart-beat. They follow in quick succession, and are succeeded by a pause or interval of silence. They are known as the first or systolic sound, and the second or diastolic sound. The first sound is caused by closure of the auriculo-ventricular valves and contraction of the heart muscle. The second sound is caused by closure of the semilunar valves. The succession of sounds and pauses is as rhythmic as the ticking of a clock. Note that in the norm rhythm is the same over all the points of auscultation of the valves, but that the accentuation of the sounds differs. Thus, if one listens over the auscultatory areas of the mitral or tricuspid valves (Fig. 115), the accent falls on the first sound, which is more booming than the second

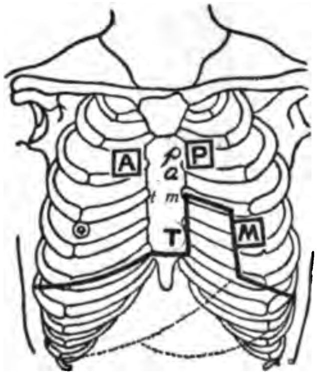

Fig. 115.—Auscultatory areas of the valves and points of maximum intensity of the murmurs: *M*, Mitral valve; *T*, tricuspid; *P*, pulmonary; *A*, aortic. Anatomic position of the cardiac valves: *t*, Tricuspid; *m*, mitral; *a*, aortic; *p*, pulmonary.

sound, which is short and sharp and has a valvular quality. One likewise notes two intervals of silence, one short, between the two sounds, and the other long, which occurs between the second and the following first sound (Fig. 116). Auscultation over the aortic and pulmonary valves shows that the accent falls on the second sound, which is the louder and clearer of the two (Fig. 116).

The *coronary arteries* supply the heart with blood and are the first branches of the aorta. Obliteration of the coronary arteries causes almost immediate death. The vessels in question are filled during diastole of the heart.

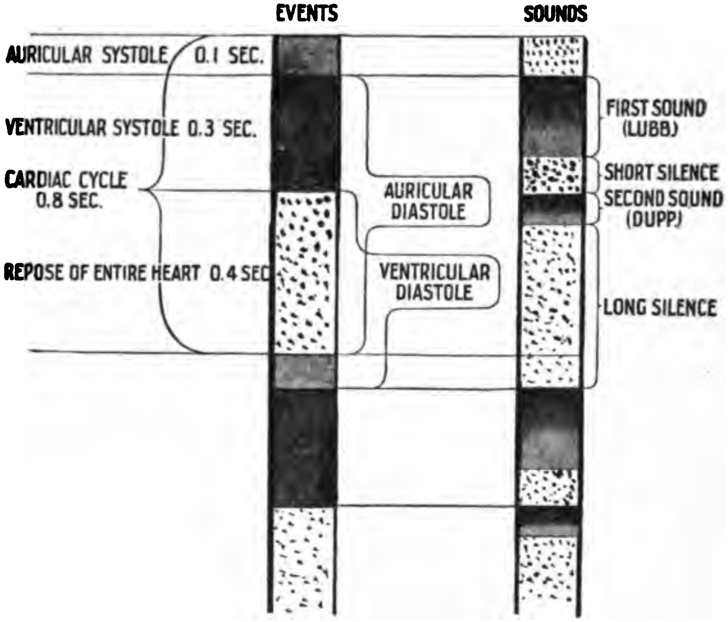

Fig. 116.—Diagram showing the events of the cardiac cycle and the sounds of the heart, with the relations of the sounds and events to each other. The duration is estimated for a pulse-rate of 72 per minute. To be read from above downward.

Innervation.—The movements of the heart are controlled by: (1) Cardiac branches of the vagus (inhibitory nerves); (2) cardiac branches of the sympathetic (augmentor and accelerator fibers); (3) sensory or afferent nerves. The vagus and sympathetic branches terminate in ganglion cells in the heart-wall, and from these cells fibers arise which are dispersed among the muscular fibers. The vagus when stimulated produces slowing or stoppage of the heart-beats, a phenomenon known as inhibition. This inhibitory influence is constantly at work, and when one or both vagi are divided, there is acceleration of the heart. If the sympathetic is stimulated, the heart-beats are accelerated and increased in force, hence the term augmentor as well as accelerator to describe the functions of this nerve. Section of the sympathetic is not followed by slowing of the heart, hence, unlike the vagus, it is not in constant action. The sensory nerves will be described later when the vasomotor nerves are discussed. Atropin, by paralyzing the inhibitory mechanism, causes augmentation of the heart-beats, whereas muscarin exercises an inhibitory action which can be antagonized by atropin. The heart may be reflexly inhibited by any irritation of the vagus directly or indirectly (a blow on the abdomen, irritation of the nasal mucosa, etc.).

Pathologic Physiology.—All diseases of the heart, whether of the valves or myocardium, eventually lead to disturbances of circulation. The phenomena associated with the latter are easier of interpretation if we study the effects of valvular lesions. The compensatory mechanism of the heart illustrates why cardiovascular disease is not at once followed by disturbances in the circulation. The normal heart can easily adapt itself to the average grades of dilatation, such as occurs during exertion; in fact, the size of the cavities of the heart varies even in health, and a dilatation is physiologic as long as the heart chamber is capable of emptying its contents during systole. What is called "getting wind" in climbing a mountain or in athletic training is practically a moderate dilatation of the right heart chambers. Any increased work on the part of the heart, if continuous, leads to an increase in the size and number of the muscle-fibers, a condition known as hypertrophy, which enables the organ to contend with additional burdens. It was formerly supposed that the heart failed to hypertrophy, owing to deficient nutrition of the patient, but it has been shown that even in emaciated animals with an artificial valvular lesion hypertrophy of the left ventricle will develop. Although a valve lesion may be of some significance in prognosis, yet the essential factor always is the question of compensation. Valvular lesions are of two kinds, narrowing of the valve openings (stenosis) and incomplete closure of the orifices (incompetency or regurgitation) due to retraction of the valves. In either condition dilatation of one of the chambers of the heart occurs, because it is overdistended with blood, and it incompletely discharges its contents at systole. When the heart hypertrophies, to overcome this latter defect, and thus prevent stasis in any part of the blood-current, the lesion is compensated. Thus compensation is practically dependent on the condition of the heart-muscle. If the heart fails to hypertrophy, or if the latter has occurred and it is subjected to burdens beyond its capacity, or in consequence of degenerative changes, the heart fails as a motor and it becomes insufficient, or, as is often said, *compensation* is broken or ruptured. Incompetence causes a diminished amount of blood to be pumped into the arterial system, hence arterial pressure is decreased, venous pressure increased, and the blood-current in the capillaries is retarded. The ventricular cavities become dilated because they cannot discharge their contents (augmented area of cardiac dullness). Overloading of the veins leads to the accumulation of fluid in the tissues; beginning first in the feet, it gradually invades the rest of the body. Of the serous cavities, the peritoneum is usually the first that is implicated (ascites). The chief cause of cardiac dropsy is disease of the mitral valve, and especially mitral stenosis. Cyanosis of the skin is an early sign, and appears as soon as the pulmonic circulation is disturbed, therefore cyanosis is more evident in mitral than in aortic lesions. The cutaneous veins are filled with blood and may become varicosed. Jaundice due to catarrh of the bile-passages is not uncommon. Cutaneous hemorrhage may develop from rupture of the capillaries or be caused by emboli. A valvular lesion, especially in children, retards development and nutrition, leading to cardiac cachexia. The notable tissue changes are thickening of the nose and clubbing of the finger-ends. The *pulse* has a specific character in nearly every valvular lesion, and in incompetence it is frequent, irregular, soft, and feeble. An intermittent pulse is caused by feeble heart contractions which are not strong enough to drive the blood to the radial artery. In such instances, if the heart is auscultated synchronously with palpation of the pulse, there are more heart-tones than pulse-beats.

Precordial pain is especially frequent in aortic incompetency, and has been attributed to irritation of the cardiac plexus by the dilated aorta. In nervous subjects the pain may be psychogenic or it may be caused by coincident disease of the coronary arteries. In myocarditis pain and cardiac distress may occur in paroxysms. Huchard[368] establishes the following clinical rules by which false *angina* can be differentiated from the true form: (1) Every angina caused by exertion is the true form, and the latter is applicable in the next rule. (2) When spontaneous attacks occur at night. (3) Every angina pectoris occurring spontaneously without any causative exertion is a false angina. (4) Thoracic pains induced by pressure over the intercostal spaces are not anginal. *Emboli* and thromboses occur. Emboli from the right ventricle pass into the pulmonary arteries and cause hemorrhagic infarctions; originating from the left ventricle, they go to the extremities, skin, retina, or the viscera. Embolism of the spleen is manifested by a sudden chill, fever, perspiration, pain in the splenic region, and enlargement of that viscus. To the latter symptoms hematuria is added when the embolus reaches the kidney. An embolus of the brain usually reaches that organ through the left carotid artery.

Lungs.—Dyspnea, especially on exertion (dyspnea of effort), is frequent. The dyspnea of heart disease is out of all proportion to the physical changes in the lungs, and is caused by pressure of the enlarged heart on the lungs, disturbed pulmonic circulation, hydrothorax, ascites, or bronchial catarrh. Hemoptysis occurs frequently in mitral disease, and may be due to congestion, rupture of vessels, or hemorrhagic infarcts. Infarcts are frequent in aortic disease. Lung infarcts give rise to a brownish-red sputum not unlike that of pneumonia. Stress has been laid on the fact that in cardiac hemoptysis the blood is clotty and blackish in color. Edema of the lungs is a frequent cause of death. It gives rise to diffuse crepitant râles and serous expectoration. Valvular lesions predispose to inflammatory lung affections; the disturbed circulation diminishing the resistance to infection. Glottis edema and epistaxis may complicate the lesions. Cardiac closely simulates bronchial asthma. *Cardiac asthma* is attributed to temporary enfeeblement of the left and disproportionate strength of the right ventricle. The following table may assist in differential diagnosis:

CARDIAC ASTHMA.	BRONCHIAL ASTHMA.
Signs of cardiac disease.	Usually absent.
Dyspnea is equally inspiratory and expiratory.	Dyspnea is expiratory.
Pulse in the early stage of paroxysm may be strong, but it soon becomes soft and small.	Pulse-tension usually increased throughout the paroxysm.
Percussion shows an extension of the borders of the lungs and obliteration of the area of superficial cardiac dullness.	Extension of lung-borders more pronounced.
Auscultation shows an absence of râles unless complicated by lung edema.	Sonorous and sibilant râles are always heard and are loudest during expiration.
Tracheal traction test (page 305) is positive.	Tracheal traction test, negative.
Cardiac stimulation will inhibit attacks and cardiotonic medication will prevent them.	No special results from cardiac stimulation.
Tests show cardiac insufficiency.	No cardiac insufficiency unless heart-weakness exists as a complication, and then the right heart is usually compromised.

Digestive Apparatus.—Venous stagnation conduces to chronic catarrh of the gastro-intestinal mucosa, resulting in dyspepsia, constipation, diarrhea, and hemorrhoids.

Liver and Spleen.—The liver participates early in the circulatory disturbances. Owing to venous engorgement of the inferior cava, the hepatic veins cannot unload, and the liver in consequence swells and may be felt below the border of the ribs as a hard and painless mass. Later, atrophy of the hepatic cells causes the organ to diminish in size. The enlarged liver may pulsate owing to transmitted pulsations from the aorta, but the knee-elbow position causes the disappearance of transmitted pulsations. Stagnation of blood in the portal circulation leads to venous engorgement of the spleen (enlarged), stomach, and intestines.

Kidneys.—From the quantity and constituents of the urine the severity of the compensation-failure may be gaged. The lower the blood-pressure in the aorta and the higher the pressure in the venæ cavæ, the more the urine partakes of the characteristics of passive renal congestion: reduction in quantity, high specific gravity, increased deposit of uric acid (brick-dust sediment), and the presence of albumin, casts, and often blood-corpuscles.

Nervous System.—Aortic lesions, particularly owing to brain anemia, are often complicated by syncopal attacks. Brain hyperemia complicating lesions causes attacks of fainting, fullness in the head, and ringing in the ears. An embolus in the left arteria fossæ sylvii will cause hemiplegia on the right side and aphasia. Temporary aphasia may be due to circulatory disturbances independent of an embolus. Mental diseases are not frequent in heart lesions. In some cases a real intellectual disturbance exists. Maniacal delirium occurs especially with mitral lesions. Such cerebral troubles are benefited by treatment directed exclusively to the heart.

Heart-rate.—The rate is usually more rapid in women than in men. Individual variations are so frequent that even a rate of 55 to 100 per minute may be regarded as normal. The rate usually becomes slower with age, and in advanced age it may be rapid owing to diminished or absent inhibitory action of the vagus. *Tachycardia* (heart-hurry) may be due to a multitude of causes (emotions, fevers, neuroses, etc.). Atropin increases the heart-rate by paralyzing the terminations of the vagus, but this only occurs in persons in whom the normal action of the nerve exists. In fever the pulse usually increases ten beats for each degree of fever and respiration increases two per minute to each degree of fever. In typhoid fever, pneumonia, and meningitis the pulse is not accelerated in proportion to the fever, whereas in scarlatina, diphtheria, and peritonitis the pulse may be very rapid in proportion to the fever. Diminished arterial pressure is usually associated with an increased pulse-rate.

Paroxysmal tachycardia is an infrequent affection characterized by spells of heart-hurry (150 to 300 pulse-beats per minute) lasting from minutes to weeks, and may occur in individuals with apparently normal hearts. Such attacks are regarded as symptomatic of acute dilatation of the heart. Subjective symptoms may be present or absent. The symptoms are dyspnea, faintness, peculiar sensations in the precordium, and a sense of great anxiety. Pressure upon the vagus may abort an attack. Galvanization of the vagus (positive pole under angle of jaw and negative pole lower down over each side of neck) may subjugate a paroxysm. In a case reported by Nothnagel attacks were jugulated by deep inspirations, and Rosenfeld's patient controlled her attack by going to bed, raising her head with her feet planted firmly against the foot of the couch, and then, taking a forced inspiration, she pressed down with all her might, with the object of closing the glottis. Nothnagel decides that a great increase in the pulse-frequency, accompanied by a weak heart-beat, speaks for paralysis of the vagus, whereas a strong impulse, fullness of the peripheral arteries, with high tension, are in favor of stimulation of the accelerators. The reflex neurosis of Rosenbach is characterized by paroxysms of tachycardia associated with oppression, dyspnea, and cyanosis. This is essentially a dyspeptic asthma; the subjects suffer from bulimia, sensitiveness of the stomach to pressure, and tympanites.

Bradycardia.—Slowness of the pulse may be physiologic. Napoleon had a pulse of only 40 per minute. Before deciding whether bradycardia really exists, it is necessary to determine if the arterial and heart-beats correspond, for while the cardiac pulsations may be 70, only 30 beats reach the radial pulse, therefore the cardiac contractions and not the pulse-beats should be counted. In the puerperal state a slow pulse (as low as 34) is a common manifestation, and is probably due to decrease in the work of the heart which follows delivery. Post-febrile bradycardia is present in convalescence from acute fevers, notably rheumatism, diphtheria, pneumonia, and typhoid fever. The cause is most probably resident in the heart-muscle and not dependent on exhaustion. Atropin (injection) does not influence the latter forms of bradycardia. If bradycardia is manifested at the fastigium of a pyrexia, it is an ominous sign, indicating degeneration of the myocardium. Disease of the digestive organs was the chief etiologic factor in Riegel's cases. It is known that digestion normally produces a slight acceleration of the pulse with augmentation of blood-pressure. This physiologic polycardia in neurotics may be so accentuated after meals that the subjects experience pulsations and fullness in the head. Cases of fatty heart have been observed where the pulse-rate was only 12 per minute, and this rate was maintained for years. Bradycardia in disease of the brain and kidneys is often an ominous sign. It is a frequent symptom in uremia. Muscarin and biliary salts can produce a slow pulse. Rapid resorption of large quantities of bile not only slows the pulse, but also causes irregular heart-action. Thus, in catarrhal icterus a slow pulse is a common occurrence. If the icterus is of some duration, bradycardia disappears. Digitalis produces a slowing of the pulse.

Heart-block (Stokes-Adams Disease).—This disease is characterized by a paroxysmal or permanent slow pulse (as low as 6 per minute), cerebral attacks consisting of vertigo, syncope, pseudo-apoplectiform or epileptiform seizures, and feeble pulsations in the right internal jugular vein directly above the clavicle and synchronous with the feeble heart-sounds. The etiology of the disease is obscure. No lesions may be noted at the autopsy. Syphilis is a frequent etiologic factor and emotional excitement may cause a seizure. The prognosis in neurotic cases without a history of syphilis nor evidence of cardiac disease is comparatively good, but in the majority of cases it is a serious disease with an unfavorable outlook. The term heart-block employed in association with this disease has the following significance: The impulse creating the heart-beat causes a peristaltic wave which commences at the venous end of the heart to contract the auricle first and the ventricle immediately thereafter. The stimulus in passing from the auricle to the ventricle must pass a band of narrow muscular tissue known as the bundle of His, which is the only muscular connection between the venous and arterial chambers. If this bundle is destroyed in a dog, then the impulse can no longer be transmitted from the auricle to the ventricle, and in consequence the ventricles beat by virtue of their own automatic rhythmicity, which is decidedly less rapid than the auricular beating. Ordinarily this automatic beating does not take place, insomuch as the tardy ventricular beating is governed by the more rapid contractions of the auricles. When the auricular impulse fails to reach the ventricles, the impulse is blocked, hence the condition known as heart-block. The inherent rate of the ventricular beat, according to Erlanger, is from 23 to 28 beats per minute in man. Heart-block may be due to an organic lesion of the myocardium or endocardium in juxtaposition to the auriculo-ventricular bundle of His, and may be partial, or by increasing the tonus of the vagus by stimulation or by compression of this nerve in the neck. In the former instance the heart-block is organic, and in the latter it is functional (neurogenic), and differentiation, which is important, may be determined by the atropin test (page 300).

Arrhythmia.—An irregular heart may be clinically manifested as an intermission when one or more beats of the heart are dropped, or as an irregularity when the beats show inequality in volume and force. The causal classification of Baumgarten is as follows: (1) Organic cerebral affections. (2) Reflex from visceral diseases. (3) Toxic from tobacco, coffee, tea, and from drugs, like digitalis, belladonna, and aconite. (4) Changes in the heart. Arrhythmia may exist for a long period without symptoms. It is usually in connection with other cardiac signs that its presence is noted. Associated with myocardial or valvular lesions, it is ominous, but as a permanent condition secondary to mental influences, it is usually without significance. Irregularity of the heart-rhythm may give no expression in the pulse. The purely neurogenic type of irregularity is observed in healthy children and young adults, and is due to overaction of the vagus. When the latter is paralyzed by atropin (gr. $\frac{1}{120}$ to $\frac{1}{60}$), the pulse becomes regular. Heart intermittency is differentiated from simple irregularity by the fact that in resumption of the cardiac contractions they are regular from the beginning.

Cardiac Murmurs.—No fallacy in medicine has been more carefully nourished than the belief that a cardiac murmur is always indicative of heart disease. Some of the most serious heart affections are unaccompanied by murmurs. "The idea that a murmur in itself and by itself is a serious thing dies hard" (Shattuck). Sir Andrew Clark gave utterance to the truism that "a murmur in itself is of little or no moment in determining the prognosis of any given case." Osler voices the opinion of the skilled cardiac diagnostician as follows: "Practitioners who are not adepts in auscultation and feel unable to estimate the value of the various heart murmurs should remember that the best judgment of the conditions may be gathered from inspection and palpation. With an apex-beat in the normal situation and regular in rhythm, the auscultatory phenomena may be practically disregarded."

The Apex-beat.—We must always remember that disease of the heart-valves of any consequence to the patient always leads to functional and structural heart changes, and unless the latter can be demonstrated, the diagnosis of valvular disease should be held in abeyance. Fowler is responsible for the epigram: "That the position of the cardiac apex is the key to the diagnosis of nearly all affections of the chest and heart." The normal location of the apex-beat excludes dilatation, hypertrophy, pericardial effusion, and heart dislocation.

Adventitious sounds originating in the pericardium, heart, and blood-vessels are known as murmurs. The auscultation of a murmur suggests many problems in diagnosis. Having determined the presence of a murmur, the first problem to unravel is its origin. The most frequent murmurs are endocardial in origin, and they are divided into organic (if caused by anatomic changes of the heart or blood-vessels) and inorganic or functional murmurs (caused by changes in the quality of the blood). An organic murmur may be obstructive or regurgitant. Two problems await solution: First, the seat of the murmur; second, the nature of the murmur.

The seat of the murmur is determined by noting its position of maximum intensity and the direction of its transmission. These facts apprise us of the valve orifice affected.

The Orifice Affected.—The position of maximum intensity of a murmur usually occurs at the point where the normal valve-sound is best heard in health. We must not forget that the heart orifices are closely situated, and therefore murmurs are created within a limited area; if it were not for the fact that murmurs have directions of selective propagation, it would be impossible to determine at which valve orifice the murmur was generated.

Direction of Transmission, Nature and Time.—In general, systolic murmurs of aortic origin are transmitted upward from the base. Systolic murmurs of mitral origin are transmitted toward the axilla. The transmission of a murmur is in the direction of the currents which produce it. Our next duty is to determine the nature of the murmur, which is ascertained by noting the time of the murmur and the direction of its propagation. Organic endocardial murmurs may be obstructive when there is obstruction to the onward flow of blood, the nature of the lesion being a stenosis, and regurgitant murmurs when there is leakage backward through a closed but incompetent valve, the nature of the lesion being an insufficiency.

Organic heart murmurs have a definite relation to the cardiac cycle, and we distinguish systolic, diastolic, and presystolic murmurs.

Systolic Murmurs.—The systolic murmurs arise from aortic obstruction and mitral and tricuspid regurgitation. Systolic murmurs are synchronous with the carotid pulse, therefore in a rapidly acting heart, the time of the murmur may be determined by palpation of the carotid pulse during auscultation. The radial pulse should not be selected because it is felt too long a time after systole.

The diastolic murmurs arise in aortic regurgitation and mitral obstruction. The so-called presystolic murmur is associated with mitral stenosis; it occurs at the end of systole, or, in case it is present at the beginning of diastole, it becomes stronger toward the end.

Character of Murmurs.—Regurgitant murmurs, as a rule, are soft and blowing. The murmur of aortic regurgitation is characterized by length and softness, while the murmur of mitral regurgitation is louder but not so long. Murmurs that are rough and high in pitch are usually generated by valves which are thickened and rigid, a common condition in chronic endocarditis. Murmurs soft and low in pitch are associated with soft exudations on the valves and are heard in endocarditis of rheumatic origin. The murmur of mitral obstruction is the only murmur which has a specific character. It is a prolonged murmur of a churning or grinding character, as if fluid were being forced with great effort through a narrow channel.

Murmurs may sometimes be felt in the heart region. The sensation is similar to that perceived upon stroking the back of a purring cat; for this reason they are called purring tremors. Like murmurs, they may be presystolic, systolic, or diastolic in time. They are nearly always indicative of a valvular lesion.

Secondary Effect of Valve Lesions.—Having ascertained the endocardial character of the murmur and the seat of the lesion, our next endeavor is to confirm our diagnosis by determining the all-important fact, viz., the secondary effect of the lesion on the heart. Without this corroboration the detection of a murmur is without diagnostic or prognostic importance.

Aortic Obstruction.—Owing to the obstruction of blood from the left ventricle, the latter must work with increased force, therefore it hypertrophies. Less blood on account of the stenosis is thrown into the arterial system, hence the pulse is small and of high tension, owing to the hypertrophied left ventricle.

Aortic Regurgitation.—The blood flowing back into the left ventricle during diastole causes this chamber of the heart to enlarge (dilatation), but compensation occurring, the dilatation is overcome by hypertrophy of the ventricle. The pulse of aortic regurgitation is pathognomonic. It is called the Corrigan or "water-hammer pulse." The impression received by the finger on the radial artery is one of recedence of the pulse-wave as soon as it strikes the finger. The phenomenon is accentuated if the arm is raised.

Mitral Regurgitation.—In this lesion the brunt of the work is thrown on the right ventricle, which dilates and hypertrophies. The increased tension of the pulmonary artery is evidenced by accentuation of the second pulmonic tone. The arterial system receives less blood, leading to insufficient nourishment of the heart through the coronary arteries, hence degeneration of the organ must ensue.

In mitral obstruction it is the left auricle which primarily hypertrophies to overcome the narrowed mitral orifice. Later, the right ventricle hypertrophies.

Accidental Heart Murmurs.—There are a number of accidental heart murmurs, functional in their nature, which admit of no definite classification. As a rule, they are unattended by any palpable changes in the heart or pulse. They are almost invariably systolic in time. In my experience they are frequent before operations and in gastric disturbances. There are many individuals, chiefly women, in whom functional murmurs appear just before an expected operation and disappear with equal readiness a few days after the operation. They might correctly be called "murmurs of apprehension."

The other class of murmurs associated with stomach disturbances, which for purposes of convenience I will designate as "murmurs of gastric origin," I have encountered frequently. They usually coexist with digestive disturbances and are sometimes of great intensity. Such individuals complain of precardial pain and pressure, and the disappearance of the latter symptoms marks the evanescence of the heart murmurs. The murmurs are in no wise associated with the pressure of a dilated stomach on the heart, as would be surmised, for I have never been able in such individuals after disappearance of the murmurs to recreate them by artificial insufflation of the stomach. Other causes must exist, and the most likely cause is reflex irritation of the cardiac nerves superinduced by the toxic products of gastric indigestion. While stress has been laid on the fact that functional murmurs are in the great majority of instances systolic in time, we must not forget that they may also be diastolic. In my experience I have encountered such murmurs in anemia, with their maximum intensity over the auscultatory situation of the aortic orifice, and they may be traced to the jugular veins in the neck, their undoubted point of origin. Care must be exercised in distinguishing such murmurs from those occurring in aortic incompetency, an error which is hardly possible, if all the facts in this chapter are carefully considered. The foregoing facts prompt us to hold in reserve the diagnosis "organic heart murmur" without repeated examinations of the heart, for it is evident that if at one examination we note, let us say, a systolic murmur at the mitral area, and at a subsequent examination a systolic tone, as a rule, there can exist no organic disease of the valve.

Analectic Review of Cardiac Valvular Murmurs.—1. The character or intensity of a murmur is no index to the gravity of the lesion producing it. The loudest murmur may be produced by the smallest lesion, and *vice versâ.*

2. The loudness of a murmur is largely dependent on the activity of the heart. Loud murmurs may become weak, and this change is an ominous sign indicating heart weakness. For the same reason they may disappear in febrile diseases and in the dying state. Faint may often be converted into loud murmurs after increasing cardiac activity by exercise and cardio-tonic medication. Complete compensation may often cause the temporary disappearance of a murmur.

3. In some individuals murmurs are louder in the recumbent than in the erect posture, especially murmurs of tricuspid and mitral origin. Murmurs should be auscultated with the patient in different postures.

4. Murmurs are less loud in inspiration than expiration.

5. Strong pressure on the chest, especially in children, may cause the disappearance of murmurs, the pressure inhibiting cardiac action.

6. When the heart is rapid or irregular in action, it is difficult to determine the time of a murmur. Remember that systolic murmurs are synchronous with the carotid pulse. Also regulate the action of the heart with digitalis.

7. Systolic are usually louder though less prolonged than diastolic murmurs.

8. When murmurs are faint, have the patient suspend respiration during auscultation.

9. Murmurs are most intense at their point of origin and they are propagated in the direction of the blood-current by which they are developed.

10. Murmurs of extrauterine origin are oftener found to proceed from the valves of the left heart, and in adults, murmurs at the tricuspid and pulmonary areas are rare.

11. In rare cases the murmur may be heard at a distance without laying the ear over the chest, and they may be perceived by the patient. Only those arising at the aortic opening have this peculiarity.

12. When two murmurs coexist at systole or diastole, they may be transmitted or be due to disease at different orifices. Thus two murmurs occurring at systole may be due to mitral insufficiency and aortic stenosis, or if occurring during diastole, to mitral stenosis and aortic insufficiency. Differentiation is possible in two ways: First, by the character of the murmur. If one is blowing and the other rough, two distinct murmurs exist. If both are similar in character, then there is only one, which is transmitted from its point of origin at one opening to the second opening. Second: Auscultate from the point where one murmur is heard to where the other exists, as from the apex to the aorta. If the murmur is everywhere distinct, but it becomes gradually louder toward one point, then it arises at this point and is transmitted to other points. If, on the contrary, it is no longer heard at some point between the apex and the aorta, and is again audible at the aorta, then there are two murmurs.

TABULAR VIEW OF ORGANIC AND INORGANIC HEART MURMURS.

Nature of Murmurs.	Cause.	Where Heard.	Character.	Diagnosis.
Endocardial Organic Murmurs	Disease either of or close to the valve where they occur.	At a point where the valve-sound is best heard in health.	Obstructive murmurs are apt to be rough and regurgitant, soft and blowing.	1. Time of occurrence. 2. Point of maximum intensity. 3. Direction of transmission. 4. Character.
Pericardial Murmurs	Rubbing together of the roughened surfaces of the pericardium.	Appear first near base of the heart, but, when pericarditis is general, best heard near the left nipple.	Sounds of a peculiar, rubbing, grating quality or of a creaking quality, like new leather.	Variability in position and quality of sounds which are not synchronous with the heart-sounds and their superficial character.
Murmurs of incompetency with healthy heart-valves	The ventricular cavity enlarges so that the valve does not coaptate to close the widened orifice.	At a point corresponding to the valve-sounds.	Soft and low in pitch and not widely transmitted.	The heart is dilated. When dilatation is overcome, the murmur disappears.
Anemic Murmurs	Many ascribe murmurs to slight dilatation of pulmonary artery and to less viscous state of the blood.	Systolic murmur at the base or apex, more often in the former situation. Loudest in the second left interspace.	Soft in character, and loudness increased by violent cardiac action.	Temporary. Disappear after cure of the anemia.
Cardio-respiratory Murmurs	A rapid and vigorous heart forcing the air out of the lung over the left ventricle.	To the left of the apex. Often heard in the second left interspace about 2 inches from sternum.	Resembles ordinary expiratory murmur; is of greatest intensity when lung is full of air.	Frequently disappear when the breath is held in deep expiration and when the patient is lying down.
Cardio-muscular Murmurs	Excited action of the heart.	Loudest at the fourth left interspace close to the sternum.	Rough or whizzing. Increased by exertion and excitement.	Loudest at end of expiration. Disappear when inspiration ends or patient lies down.

13. Never diagnose a valvular lesion without taking into consideration the effects of such a lesion on the heart and blood-vessels and demonstrating them.

Pericardial Murmurs.—These are friction sounds produced by the rubbing of one surface of the pericardium upon the other when roughened by a fibrinous exudate which occurs in the plastic variety of pericarditis. The following characteristics will aid in distinguishing pericardial or exocardial from endocardial murmurs:

1. Unlike endocardial murmurs, which are limited to a certain phase of the heart's action, they might be systolic, diastolic, or both, or even presystolic.

2. They are increased in intensity upon pressure with the stethoscope, which maneuver facilitates the friction between the pericardial layers.

3. During inspiration the lung approximates the layers of the pericardium, thus increasing, during this phase of respiration, pericardial murmurs. Endocardial murmurs by the same act are diminished in intensity, because the interposed lung offers a poor medium of conduction to the chest-wall.

4. The closer the two layers of the pericardium are approximated, the louder the murmur. To facilitate this approximation, I would suggest pressure being made in the intercostal spaces, and not on the ribs, as is the conventional practice. The same maneuver is applicable in the elicitation of pleural friction sounds. To make pressure with the stethoscope in the intercostal space, a phonendoscopic attachment may be fitted to the chest-piece of any stethoscope according to the illustration (Fig. 69). A piece of tin may be easily fitted by any tinsmith. In the center of the tin a rod terminating in a small button is screwed.

5. They are circumscribed and are not transmitted beyond the area of cardiac dullness.

6. Change of position exerts a greater influence on the character of pericardial than endocardial murmurs. The former are especially distinct when the patient is in the sitting posture, with the body inclined to the left side.

7. They give the impression of being superficial in origin.

8. They frequently change their character, whereas the character of endocardial murmurs is almost constant.

TABULAR REVIEW OF CARDIAC VALVULAR MURMURS.*

Time of Murmur.	Usual Seat of Murmur.	Transmission of Murmur.	Cause of Murmur.
Aortic Orifice—Systolic Murmurs. (Aortic obstruction.)	Second right intercostal space close to the border of the sternum.	Over the carotid arteries. The most widely diffused of all cardiac murmurs.	Obstruction to outward flow of blood through aortic orifice.
Mitral Orifice—Systolic Murmurs. (Mitral regurgitation.)	At the apex.	Axilla and angle of scapula. Sometimes heard loudest along left border of sternum.	Regurgitation of blood through mitral orifice into left auricle.
Pulmonary Orifice—Systolic Murmur. (Pulmonary obstruction.)	Second left intercostal space close to sternal border.	Murmur is not transmitted to the vessels of the neck.	Obstruction to outward flow of blood through pulmonary orifice.
Tricuspid Orifice—Systolic Murmur. (Tricuspid regurgitation.)	Median line of sternum on a level with fifth intercostal cartilage.	Limited in transmission to the limits of percussion dullness.	Regurgitation of blood through tricuspid orifice into right auricle.
Aortic Orifice—Diastolic Murmur. (Aortic regurgitation.)	Second right intercostal space close to the border of the sternum.	Middle of sternum—also heard over aorta and carotids.	Regurgitation of blood through aortic orifice into left ventricle.
Mitral Orifice—Diastolic Murmur. (Mitral obstruction.)	At the apex or just at the position of the apex-beat.	Usually limited to the apex-beat. Rarely diffused.	Obstruction to flow of blood from the left auricle to left ventricle.
Pulmonary Orifice—Diastolic Murmur. (Pulmonary regurgitation.)	Second left intercostal space close to the border of the sternum.	Transmitted down the sternum. Only to be distinguished from aortic regurgitation by pulse.	Regurgitation of blood through pulmonary orifice into right ventricle.
Tricuspid Orifice—Diastolic Murmur. (Tricuspid stenosis.)	Median line of sternum on a level with fifth intercostal cartilage.	Base of heart or to the right axilla.	Obstruction to flow of blood from right auricle into right ventricle.

9. They are rough, grating to and fro, or rubbing and scratching sounds.

10. When doubt arises whether a murmur is pericardial or endocardial in origin, always remember that organic endocardial murmurs modify the pulse and induce secondary effects upon the muscle of the heart.

Pleuro-pericardial Murmurs.—These murmurs often simulate pericardial murmurs. They arise when the pleura or peritoneum adjacent to the heart is roughened. They are modified by respiratory movement, disappearing or diminishing when the breathing is suspended or disappearing after forced expiration. Deep inspiration will usually accentuate them.

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* Modified from "Manual of Clinical Diagnosis," by Dr. Albert Abrams, 1894.

Cardio-respiratory Murmurs.—These are sounds synchronous with the heart's action, produced outside this organ and heard usually to the left of the apex-beat. Two factors enter into the production of these murmurs: (1) Forcible expulsion of air from the lung by the heart striking against it. (2) With each cardiac contraction the bulk of the heart is reduced in size and a corresponding vacuum produced in the chest, which the lung compensates by expanding, thus producing a murmur.

Anemic Murmurs.—In anemia, murmurs are frequently heard over the heart and vessels. They are endowed with certain characteristics: (1) They are soft and blowing in character and not prolonged. (2) They are systolic in time. (3) Generally loudest at the base of the heart, and especially over the pulmonary orifice, a point where organic systolic murmurs are often heard. The chief means of differentiation between the two lies in the fact that with organic we find dilatation and hypertrophy of the heart, which are usually absent in anemic murmurs. (4) They are unaccompanied by changes in the size of the heart. (5) They frequently change their character. (6) They are accompanied by anemic symptoms and murmurs in the veins of the neck. (7) They are louder in the recumbent than in the upright position. (8) They are not transmitted away from the heart. (9) Under appropriate treatment with chalybeates they can be made to disappear.

TESTS FOR HEART SUFFICIENCY.*

1. *The Pulse Method.*—In the cardiopath the pulse is altered in character after body-movements and physical exertion in a more pronounced manner than in health, and such alteration is in proportion to the insufficiency of the heart-muscle. When the heart is healthy and one counts the pulse first in the erect and again in the recumbent posture, a retardation of the pulse in the latter position

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* *Vide* Blood-pressure in Disease for estimating heart sufficiency.

from 10 to 12 beats per minute is noted. If the heart-muscle is weak, then the pulse retardation in the recumbent posture becomes less and less pronounced, the greater the degree of cardiac insufficiency, until in pronounced grades of the latter the pulse frequency may even be greater in the recumbent than in the erect posture.

2. *Blood-pressure Method.*—This, like the foregoing, is original with Mendelsohn,[177] and is dependent on the fact that muscular work is associated with alterations in the arterial blood-pressure. While in health muscular exertion causes a rise in blood-pressure, in insufficiency of the heart this rule is reversed, viz., muscular exertion reduces the blood-pressure. The less evident the rise in pressure after muscular exertion, and the deeper the remissions of the blood-pressure curve and the less muscular exercise it takes, *cæteris paribus*, to produce such remissions of pressure, and the longer it takes for the blood-pressure curve to attain the normal, the greater the functional incapacity of the heart.

3. *Vasomotor Method.*—This method, already described (page 372), requires, like the foregoing, the use of a sphygmomanometer (*q. v.*).

4. *Herz Method.*[178]—This consists of having the patient bend his forearm and straighten it again several times in succession without exertion and to concentrate his attention on the movement. In heart insufficiency only, is there any retardation in the pulse after the movement.

5. *Heitler Method.*[179]—This method seeks to determine the sufficiency of the heart-muscle by making a series of percussion blows over the cardiac region. If thereafter the cardiac dullness is much diminished (the area having been previously determined), it is an evidence, Heitler argues, that the cardiac musculature is sufficient, for the tendency of the normal muscle tonus of the heart is to maintain a limited patch of dullness. The observation of Heitler is faulty insomuch as he fails to take into consideration the lung reflex (page 497) which is likewise provoked by the percussion, and which also reduces the area of cardiac dullness. The same error is perpetrated by Schott, who attempts to demonstrate by percussion the effects on the heart of the carbonated baths, which also elicit the lung reflex. By excluding the latter reflex by the next method, percussion is of value. If consideration is only taken

of the deep cardiac dullness (elicited by forcible percussion) the method of Heitler may be regarded as trustworthy.

6. *Cardio-splanchnic Method.*—It is known that there is a tendency of the blood to accumulate in the splanchnic area. Like the generality of veins, the great splanchnic veins are very susceptible to pressure, and the amount of blood within them is greatly influenced by pressure on the abdominal walls. Mere pressure of the latter suffices to squeeze out of them a large quantity of blood. The removal of stays in women often induces a feeling of faintness; the same symptom is observed when ascitic fluid is removed, and in susceptible persons when the bladder is emptied or feces discharged, and in a very sick person the administration of a purgative may be followed by collapse symptoms. In all such instances there is a determination of blood to the splanchnic area with consequent brain-anemia. Hill has shown that in consequence of some failure in certain compensatory mechanisms the blood gravitates into the splanchnic veins from the right heart, and that abdominal compression will send the blood back from the veins to the right heart, thus re-establishing the circulation. If the lower sternal region, *i. e.*, the sternum contiguous to the heart, is percussed, a resonant or even hyperresonant tone is elicited; if now the abdomen is vigorously compressed, a dull or even flat sound is obtained, due to the expression of blood from the splanchnic veins and sending it back to the heart. This maneuver has been described more fully elsewhere,[180] and is called the *cardio-splanchnic phenomenon* (Fig. 117). The patch of dullness is exaggerated in intra-abdominal insufficiency when blood tends to accumulate in excess in the intra-abdominal veins. My contention has always been that the idiopathic syncope and vertiginous

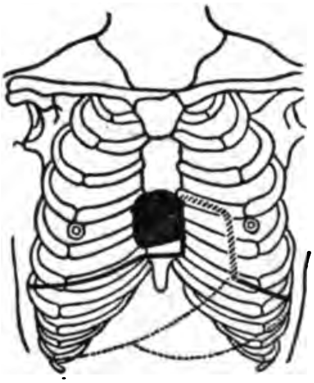

Fig. 117.—The cardiosplanchnic phenomenon. The black area is the circumscribed patch of dullness elicited after vigorous compression of the abdomen; the contiguous area is the superficial or absolute cardiac dullness of the heart.

attacks in Glénard's disease are not wholly dependent on dislocation of the viscera, but are partly due to venous stagnation in the abdominal veins. More recently I have devised a simple apparatus (abdominal compressor) for expressing the blood more effectually from the abdominal veins. It consists of a belt (Fig. 118) to which a large pelote is attached, and by means of a screw the latter is made to compress the abdomen. It enables one to determine accurately the boundaries of the heart and the aorta and sufficiency of the heart-muscle. Note that the cardiosplanchnic phenomenon is evanescent, not very pronounced, but practically always present; that it is at once dispelled after a few forced inspirations, and that it is limited to the right ventricle. After the use of the abdominal compressor the dullness is more pronounced, durable, and comprises the entire area of the heart and the great *vessel area.* I wish to emphasize the importance of *palpatory percussion* in the elicitation of the several phenomena which are cited in this work. This method of percussion yields results which escape the observer who is influenced only by what he hears and not by what he feels. If the area of the heart is defined by aid of the vibro-suppressor (page 512), and after the removal of the latter the abdominal compressor is applied, the normal heart will show no augmentation of area, notwithstanding the expression of a large quantity of

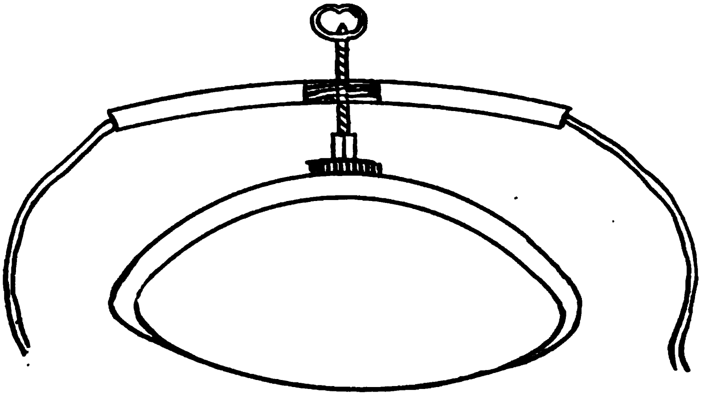

Fig. 118 —The abdominal compressor. The pelote is about 10 cm. wide and 15 cm. long. The compressor is applied to the abdomen by means of a belt, and by means of the screw the contents of the abdomen are compressed.

blood from the splanchnic area to the heart. In insufficiency of the organ, however, the cardiac area will be increased to the right or left, or both, in consequence of the weakened myocardium yielding to augmented intraventricular tension. It is known that the normal heart-muscle possesses the property of increasing the size of its cavities without any corresponding augmentation of tension of its walls. If the boundaries of the heart are primarily defined, and then the precordia is vigorously struck by means of a hammer, the heart reflex (pages 375, 627) may be elicited, and in the elicitation of the latter the myocardial vigor is determined. Naturally, if the heart reflex is present, the boundaries of the heart will recede as determined by percussion. To obtain the heart reflex by percussion, the vibrosuppressor is used in preference to the abdominal compressor, for the latter may so increase intraventricular tension as to prevent the reflex in question. This method dispenses with the use of the *x*-rays, and while the lung reflex is coincidently provoked, it does not interfere with cardiac percussion. It may be mentioned that in a few instances the abdominal compressor does not express enough blood from the splanchic area to influence cardiac percussion, and this is indicated by the fact that the intensity of cardiac dullness is the same after as before the use of the compressor.

7. *Jürgensen's Method.*—According to this maneuver, latent heart insufficiency may be determined by having the patient micturate several times a day and taking the specific gravity of the different samples of urine. In insufficiency of the heart there is a decided difference in specific gravity of the samples.

8. *Method of Oertel.*—This takes into consideration the fact that there is a decided difference between the ingestion of fluid and the excretion of urine. At least four days are required for the observation. In the first two days the patient consumes his ordinary food, but is requested to measure in a convenient way all the fluid ingested and the urine excreted in twenty-four hours. On the following two days the ingestion of fluid is diminished and the character of food unaltered. Normally from 18 to 32 per cent. less urine is excreted in proportion to the fluid ingested, and if cardiac insufficiency exists, the amount of urine excreted is diminished.

9. *Method of Smith.*—Have the patient exert himself smartly for a few minutes, then the number of beats in the next four or five quarters of a minute should be registered and compared. If the muscle is good, the numbers will rapidly diminish with each succeeding fifteen seconds, till the rate is regained which was previously present. If the increased frequency continues, it is a suspicious circumstance against the muscle.

10. *Method of Katzenstein.*—Levy[238] notes his observations on this method, which are as follows: After determining the blood-pressure and the pulse on the reclining patient, both of the femoral arteries are compressed with the middle finger of each hand at Poupart's ligament, the other fingers testing whether the compression is absolute. With normal heart-energy the blood-pressure then rises by from 5 to 15 mm. mercury, while the pulse remains unaffected or drops. On relinquishing the compression the blood-pressure gradually returns to normal. In case of hypertrophy of the heart, aortic insufficiency, aortic sclerosis, or nephritis, the blood-pressure rises much higher during the compression. A slightly enfeebled heart is not able to raise the blood-pressure when the obstruction to the circulation is interposed, and with a much enfeebled heart the blood-pressure actually sinks under the compression, while in both events the pulse becomes more or less accelerated. The respiration is kept superficial during the compression. The results of Levy's research have confirmed the great value of this means of determining the power of the heart. It is especially instructive in examining the heart after acute infectious diseases and in heart affections of all kinds, and it will be found a valuable aid in examining in case of accidents and for life or accident insurance. It must not be forgotten, however, that in very excitable, nervous, and emotional patients the findings cannot be accepted as always reliable.

11. *Heart Reflex Method.*—This simple and efficient method is executed as follows: After taking the blood-pressure, fix over the heart-region a pleximeter and strike the latter a series of vigorous blows with the hammer, after which immediately take the pressure again. If the myocardium is sufficient, the blood-pressure remains the same or rises; otherwise it falls, and the rise and

fall are in proportion respectively to the vigor and insufficiency of the heart-muscle: *e. g.*,

BLOOD-PRESSURE BEFORE AND AFTER EXCITATION OF THE HEART-REGION.

BEFORE.	AFTER.	CONCLUSION.
120 mm.	140 mm.	Myocardium very strong.
135 mm.	138 mm.	Myocardial sufficiency.
190 mm.	155 mm.	Myocardial insufficiency.

Concussion of the heart-region elicits a maximum heart reflex with a temporary augmentation of vigor if the myocardium is normal, otherwise the stimulation is in the nature of a shock. With this method the vasomotor factor of blood-pressure is excluded.

Heart-sounds.—The writer in his studies[181] of *stethophonometry* demonstrated that the intensity of the heart-tones is no accurate gage of cardiac strength. One may hear very loud heart-sounds in anemic and emaciated persons, and yet the cardiac strength may be below the average, and, conversely, the sounds may be muffled, even though the organ is vigorous. This apparent contradiction of statement lies in the fact that two factors contribute to the genesis of heart-sounds, viz., muscle and valves. The former yields a dull and prolonged sound and the latter a short and sharp sound. While it is true that the intensity of sound varies inversely as the square of the distance from the sounding body, this law is not strictly applicable to the heart-tones, owing to prevailing factors which interfere with propitious conductivity. One may improvise a *stethophonometer* by using soft-rubber tubes in connection with an ordinary stethoscope, and by occluding one tube by digital compression during auscultation the intensity of the tones may be compared. It is evident that, once having established the intensity of the tones, this fact is important in later observations. The same method is applicable in gaging the intensity of the respiratory murmur, notably of the pulmonary apices, and marked differences between the two may frequently be recognized by mere compression of one of the connecting tubes of the stethoscope.

Stethophonometer.—The writer some years back devised an apparatus for measuring the intensity of the heart-tones, but since then he has relinquished his apparatus in favor of the simpler and more accurate instrument of Bock[342] and Oertel (Fig. 119). The instrument consists of a binaural stethoscope with a metal combination tube, which is the essential part. This consists of two metallic tubes, the one being graduated vertically, the other transversely in millimeters. The third, outer metallic tube glides up and down over the other two for half their length. By rotating the middle tube by means of its milled head, and sliding the outer tube downward, an opening measuring 40 mm. may be obtained. The more intense the sound the larger the opening required to obliterate it. The instrument should be applied with the outer sliding tube closed and the middle and inner ones separated by an interval of 2 mm. The sliding tube is then pushed slowly down until the particular sound has disappeared. The area of the opening necessary to obliterate the sound is then determined by means of millimeter graduations on the tubes. Bock after the examination of a number of healthy subjects found that the open-

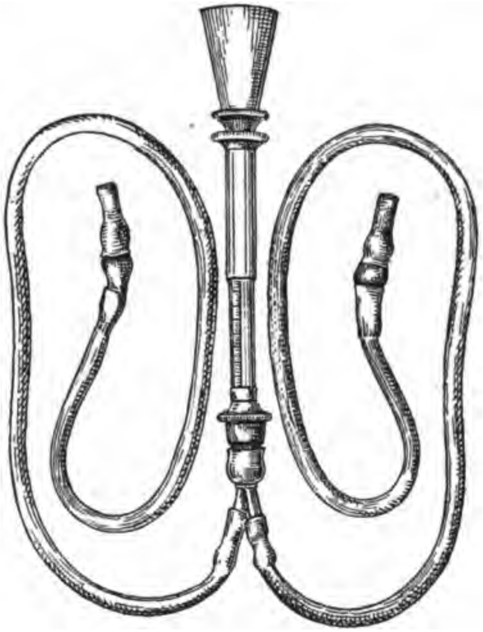

Fig. 119.—Bock's stethophonometer.

ing necessary to obliterate the first mitral tone was 40; the second pulmonic tone, 18; and for the second arotic tone, 20.

In studying the mitral tones the instrument must be firmly applied to the chest, although this precaution is unnecessary in auscultating the second pulmonary and aortic tones. Each individual tone alone is of no diagnostic importance; on the contrary, it is only by a comparison of the tones that conclusions may be formulated. With a relatively weak heart-muscle the first mitral tone can be comparatively low without disease of the muscle in question, but the second pulmonic tone (which determines the force of the right ventricle) and the second aortic tone (which measures the resistance in the arterial system) must maintain a definite relation to the enfeebled first mitral tone. In neurasthenics the strength of the mitral tone is increased, but the pulmonic and aortic tones are equally loud. An important aid[315] furnished by the stethophonometer is in distinguishing organic from inorganic murmurs and autochthonous from transmitted murmurs. Inhibition of the heart was advocated by me for the same purpose (page 534), but I found that by interposing increased resistance to transmission, inorganic and transmitted murmurs may be made to disappear, to be replaced by tones. Let one suppose that at the apex, in aortic incompetency, a diastolic murmur is audible. If, now, we introduce a certain amount of resistance by the stethophonometer, the murmur will disappear, to be replaced by a tone. The murmur in question is therefore a transmitted one. Or, again, systolic murmurs are heard over all the ostia. The systolic murmurs disappear and are replaced by tones by interposing augmented resistance. If evidence of anemia is present, one concludes that the murmurs were anemic. Murmurs are more easily suppressed than tones by the interposition of resistance to transmission.

The writer has, in previous communications,* referred to the great clinical value to be attached to stethophonometry as a means of registering the intensity of the cardio-respiratory sounds. By means of this aid, we are in a position to gage the progress of cardiac lesions, valvular and myocardial, and to determine the efficiency and action of cardiac tonics.

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* Medical News, July 8, 1899; New York Medical Journal, February 16, 1901. "Diseases of the Heart," Abrams, 1900.

Intensity of the Heart-sounds.—In insufficiency of the heart the sounds may be loud, but this must not be interpreted as strength, for, the muscular component of the sounds being absent, the sounds have a short, flapping quality (valvular component predominating) indicating weakness. In commencing heart insufficiency it is the first sound that primarily shows enfeeblement; and later, the second sound. Thus, in progressive cardiac weakness the first sound at the apex loses its accentuation and approaches in character the second sound, until finally in severe cases it is barely audible or absent. Over the aorta and pulmonary artery the accent in the norm is on the second sound. Under the age of thirty years the second sound over the pulmonary orifice is louder than over the aorta; during middle age they are about equal; whereas later the second aortic sound is louder, owing to sclerosis of that vessel. In enfeeblement of the left ventricle the second aortic sound loses its accentuation, and the same holds good for the corresponding pulmonic sound in weakness of the right ventricle. Thus, in pneumonia circulatory failure need not be feared, as a rule, if accentuation of the second pulmonic sound is maintained; its disappearance indicates failure of the right ventricle. It is evident that in determining the sufficiency of the right ventricle auscultation of the pulmonic sounds (not palpation of the pulse) is alone adequate. In reduplication of the heart-sounds one hears a triple in lieu of the double normal sound, caused by a doubling of either the first or second sound. Such sounds, expressed by the words "rat-ta-tat," simulate the triple foot-fall of a horse at canter, and are known as the galloping rhythm (*bruit de galop*). The latter is frequently encountered in cardiac dilatation and disturbed compensation. In the norm we noted that there is a brief period of silence between the first and second sound, and a long period after the second sound. This rhythm is maintained even if the heart is beating rapidly. Variation in the length of the silence is an important sign when the cardiac muscle is enfeebled. First we have the condition known as *embryocardia*, because it resembles the character of the fetal heart-sounds (like the tick-tack of a watch). Here the first resembles the second sound, and the short and long silences are equal in length, so that the rhythm is in double time. This sign is of ominous import in fevers, indicating a weak heart. In another form of this altered rhythm the second period of rest (long silence) is unusually prolonged, and the first and the second sounds are short and sharp. The latter condition is likewise observed in weakness of the cardiac musculature and when the toxic action of digitalis is manifested.

TESTS FOR VAGUS SUFFICIENCY.

It has already been noted that the rapidity and force of cardiac action are regulated by the pneumogastric or vagus nerve, which inhibits it, and the sympathetic, which accelerates it. It is important to know the condition of the vagus in neuroses and other cardiac affections, and this subject has been fully discussed on page 534. Many persons can voluntarily produce intermittency of the heart, and among Indian sorcerers the phenomenon is regarded as a marvelous feat. Donders solved the riddle as follows: By voluntary contraction of the neck muscles innervated by the nervus accessorius, the branches of the latter running in the vagus path were irritated, resulting in temporary stoppage of the heart-action.

In addition to the method cited (page 534) for inducing cardiac inhibition, the following method is simpler, and, as a rule, more effective. It consists of forcible compression of the abdominal muscles in a manner similar to that employed in defecation, and the effect on the pulse is immediate (Fig. 1) if the vagus tonus is intact. It is known that afferent nerves from the abdomen and intestine are in close communication with the cardio-inhibitory center in the medulla, so that reflex inhibition of the heart can easily be produced in the frog by tapping a loop of the intestine with the handle of a scalpel. Severe abdominal affections, like peritonitis and appendicitis, are frequently attended with symptoms of heart-collapse, owing, no doubt, to reflex inhibition of the heart. Aside from the value of this maneuver in testing the tone of the vagus, it is applicable in another direction. Sewall, of Denver, has shown that cardiac murmurs may be inhibited under increased pressure of the stethoscope, and Friedreich, preceding Sewall, demonstrated that pressure on the chest will often cause murmurs to disappear. Such disappearance is especially observed in the young with elastic thoraxes. I wish to observe parenthetically that if the pad of the vibro-suppressor (Fig. 67) is fixed to any part of the heart region in a young subject and considerable pressure is exerted, murmurs may be created. Thus far I have not been able to properly interpret the latter phenomenon. Friedreich supposed that the disappearance of cardiac murmurs by pressure with the stethoscope was caused by mechanic interference with the cardiac movements. My own investigations show that such pressure is equivalent to cutaneous irritation, and will induce the heart reflex, and in this way modify the cardiac murmurs. It is known that the loudness of a murmur indicates, as a rule, good compensation. Increase in the force of the heart-action will usually increase the intensity of a murmur; in fact, it is often necessary when a faint murmur is present, to augment its intensity by subjecting the patient to some exertion, such as walking or breathing rapidly. Even loud murmurs may become weak or disappear in the course of febrile affections and in the moribund state owing to the slow and feeble action of the heart. It is the latter fact which is of special significance to us in the clinical application of the inhibition maneuver.

In irregular action of the heart or in delirium cordis the inhibition maneuver, by momentarily inhibiting the rapidity of the heart, renders signal service in determining the time of a murmur; the maneuver thus acting like the physiologic action of digitalis.

By interposing increasing resistance to transmission by means of a stethophonometer (*q. v.*), the results may be attained without resorting to the methods for inducing inhibition of the heart.

The citation of cases is wearisome, yet, as many of the clinical signs of cardiac disease here mentioned are not recorded elsewhere, their application may seem apposite. Thus, recently, in auscultating the heart of a patient, systolic murmurs were heard over all the ostia, and, as it was necessary to determine their genesis, the following facts were elicited:

1. After percussion of the muscles (*tapotement*) the murmurs disappeared temporarily over the pulmonary and tricuspid ostia.
2. After concussion of the precardial region the murmurs over the aorta and mitral orifice likewise disappeared.
3. The use of the *vibrosuppressor* demonstrated dilatation of both ventricles.

4. *Inhibition* of the heart demonstrated that the murmurs were not replaced by tones.

5. The *heart reflex* was readily elicited.

Diagnosis.—Relative insufficiency of the valvular orifices dependent on a neuro-muscular dilatation of the heart.

Analysis of the Signs.—1. Tapotement of the muscles by inducing the *heart reflex* strictly limited to the right ventricle narrows the pulmonary and tricuspid ostia, thus enabling systolic tones to supplant the murmurs.

2. Concussion of the precardial region induces the heart reflex, and the retraction of the myocardium thus evoked causes a disappearance of the murmurs over all the orifices.

3. The *vibrosuppressor* (or pressure of the lower end of the sternum), while percussion of the heart is executed at the end of a forced expiration (while the patient suspends respiration), is unquestionably the simplest, and, relatively speaking, the most accurate method of defining the borders of the organ by forcible percussion without disregarding the percussional sense of resistance.

4. Insomuch as tones did not replace murmurs after *inhibition of the heart,* anemic murmurs were excluded.

5. By the use of vibrosuppression the heart reflex was readily elicited. The latter demonstrated that the myocardium was intact, for in dilatation dependent on a myocarditis no reflex could be provoked. The patient was a neurasthenic and recovered completely after a rest-cure.

THE BLOOD-VESSELS.

Physiology.—The blood-pressure is most pronounced in the arteries and least pronounced in the veins, and in the capillaries it is intermediate between the veins and arteries. Thus the blood circulates continuously in the direction of the lowest pressure (arteries to veins). *Arterial pressure* or tension is made up of four factors: (1) Ventricular pressure. (2) Peripheral resistance. (3) Elasticity of the arterial walls. (4) The volume of the circulating blood. *Innervation* of the blood-vessels is effected through the vasomotor nervous system, which consists of the center in the bulb, subsidiary centers in the spinal cord, and vasomotor nerves. The latter are of two kinds: vasoconstrictor nerves, which when stimulated cause contraction of the vessels, and vasodilator nerves, which dilate the vessels. The latter supply the musculature of the vessels and regulate their caliber, and their most pronounced action is on the arterioles, which contain relatively the largest amount of muscular tissue. In the norm the arterioles are in a state of tonic contraction, and this is what constitutes the peripheral resistance which helps to maintain the blood-pressure and thus promotes the circulation of the blood. By means of the vasomotor apparatus the amount of blood supplied to an organ is regulated. Thus, during digestion more blood must be supplied to the digestive organs, hence the arterioles of the splanchnic area are relaxed and there is a constriction of the vessels in other areas, as, for example, the skin; the chilly sensations after a meal are attributable to the latter fact. In certain organs, like the lung and brain, there are no vasomotor nerves, because there are no variations in the blood-supply. There are afferent impulses which may reflexly excite the vasomotor center in the medulla, and such impulses are divided into pressor and depressor. Most sensory nerves contain pressor fibers which when stimulated cause a rise of blood-pressure, whereas the depressor fibers also present in many sensory nerves will when stimulated cause a fall of blood-pressure. A distinct nerve known as the depressor nerve exists in animals in the trunk of the vagus, or as a separate branch running from the heart or the commencement of the aorta, and reaches the vasomotor center by joining the vagus.

Pathologic Physiology.—The primary factor in blood-pressure is the force of ventricular systole, and any increase in the volume-output causes a rise, and conversely a fall, in pressure, provided the peripheral resistance is the same. In animals the pulse-rate is slowed when the arterial pressure is raised and accelerated when lowered. A continued high blood-pressure entails increased work on the part of the heart, but the abnormal tension of the ventricular wall stimulates the filaments of the depressor nerve and thus automatically causes a fall of pressure. Another protective mechanism exists to prevent excessive blood-pressure, and that is, when the peripheral resistance is very much augmented, the volume-output of the ventricle diminishes. *Peripheral resistance*, as has been noted, is made up of the tonus of the arterioles, but there are minor factors also concerned, notably, friction due to the viscosity of the blood and the subdivisions of the arterial tree. It has been shown that the veins also possess tonus. Thus, stimulation of a splanchnic nerve will produce a contraction of the portal vein. The vasodilator have not the same physiologic value as the constrictor nerves, for their division causes no narrowing of the vessel, hence they possess no tonus. It has been shown that stimulation of the muscles and the mucosa of the rectum and vagina will cause a fall of blood-pressure, and this fact is more evident during anesthesia. In the latter instance depressor in lieu of pressor reflexes occur. The abdominal vessels supplied by the splanchnic nerves have the most pronounced influence on the general blood-pressure, for the evident reason that they are sufficiently capacious to hold practically all the blood-volume of the body. *Arterial elasticity* diminishes the work of the heart. Hasebroek contends that there is a propulsive energy at the periphery independent of that in the heart, and that the periphery represents another second independent pumping apparatus, coupled with that of the heart. The periphery has not only its elastic contraction and expansion, but also its active diastole and systole in the arteries. This diastolic-systolic activity is manifested in the capillaries as a sucking-in, an inspiration, as it were, while in the arteries it is more of a propulsive energy. Both these forces combine to create an independent and forcible stream into the veins, which are passive, and merely serve as a passive reservoir for the blood-stream.

The *blood-volume* has only a subordinate influence on blood-pressure, as many experiments show. When the blood-volume is diminished, pressure is maintained by peripheral contraction of the arterioles, and when the volume is increased, certain compensatory mechanisms come into play, viz., dilatation of the vessels, transudation into serous cavities and lymph-spaces, and increased activity of the secreting organs. Another important factor in compensation is dilatation of the arterioles of the abdominal viscera caused by stimulation of the depressor nerve.

Normal Blood-pressure.—Pressure, like temperature and the rate of respiration, is subject to fluctuations. Most of the recorded results have been obtained with the *Riva-Rocci apparatus*, and the figures quoted represent the systolic pressure. Cook and Briggs present the following as representing the average pressure:

Children up to two years	75 to 90 mm.
Children after two years	90 to 110 mm.
Young adult males, about	130 mm.
Women	10 to 15 mm. lower.

A pressure below 70 mm. signifies very low, and above 200 mm. very high tension. The lowest blood-pressure compatible with life was found to be from 40 to 45 mm., and this only occurs in the moribund state.

Janeway has never seen a pressure above 180 mm. in a normal person, and seldom one above 160 mm. There are postural variations of pressure (page 1003), hence all pressure estimations should be taken in the same position. Sleep lowers the pressure. Tobacco either increases or diminishes the pressure according to whether the subject experiences a stimulating or sedative effect; this, at least, has been my observation. Emotional influences and intellectual application increase the pressure. Muscular exertion increases the pressure, owing to augmented ventricular force; if, however, exertion is carried to exhaustion, the pressure falls.

Blood-pressure in Disease.*—Among the dominant factors inducing high pressure (*hypertension*) are pains of all kinds which reflexly cause a stimulation of vasomotor tone. Drugs like strychnin, digitalis, adrenalin, and other cardiotonics act by increasing either the peripheral resistance (vasoconstriction) or cardiac energy or both. Vasoconstriction is evoked by many toxic conditions (plumbism, nicotinism, gout, uremia). No doubt a toxic factor is also present in many psychoses. During labor pains two factors are present, the pain and the increased volume of blood sent to the heart by compression of the abdominal vessels. In renal affections the cause of high pressure is due to a number of conditions, notably, cardiac hypertrophy and increased peripheral resistance due to a vasomotor spasm provoked by the irritating action of waste-products in the blood or degeneration of the peripheral vessels or both. Hypertension necessarily increases the work of the heart unless a compensatory factor is brought into play, and the primary effect is to cause cardiac hypertrophy. A hypertrophic heart is by no means as good as a normal one, as the old dictum runs, for, sooner or later, that heart will become insufficient. Hypertension diminishes the elastic distensibility of the arterial wall, and this in turn conduces to dilatation (aneurism) and rupture (cerebral hemorrhage) of the vessels. Diminished pressure (*hypotension*) is usually regarded as such when the systolic pressure in an adult is below 100 mm. Any or all of the factors concerned in blood-pressure may be involved; wasting diseases reduce pressure by compromising all these factors. The vasodilators reduce pressure by diminishing the peripheral resistance and chloroform acts by directly paralyzing the vasomotor center or heart. In acute infectious diseases the fall in pressure is due in part to vasomotor paralysis and in part to weakness of the heart-muscle. Hypotension causes blood to accumulate in the veins (notably the abdominal) and diminishes the rapidity of the circulation. The vigor of the heart becomes compromised because it receives less blood.

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* The reader is referred to page 371 for the personal views of the author concerning blood-pressure.

In affections of the *nervous system* Pal found that in tabes, during the occurrence of lightning pains, the pressure fell, and that during gastric and abdominal crises there was an enormous augmentation of pressure, hence he concludes that the latter are caused by a spasm of the splanchnic vessels. Cerebral hemorrhage, like all other conditions increasing intracranial tension, will cause an increase of pressure in proportion to the degree of such tension. A high and rising pressure points to more bleeding and a progressive failure of the circulation in the medulla. The observations of Bruce show that in insomnia there are cases with high and low pressure, and that the administration of *erythrol tetranitrate* to the former acted as a hypnotic (if it reduced tension).

The tension in *arteriosclerosis* has already be n discussed (page 378). The arteries may be thickened and yet no rise of pressure exists; in fact, if the heart-muscle is weak, the pressure may even be lower than normal. Janeway concludes that high pressure in this disease indicates involvement of the small arteries, especially in the splanchnic circulation. Among the symptoms of arteriosclerosis are headache, vertigo, apoplectiform attacks, and irritability. Such symptoms are accentuated when the pressure is high, and are aggravated by raising the latter with subcutaneous injections of adrenalin and ameliorated by the use of vasodilators. Amyl nitrite inhalation may be tried to rapidly secure the latter action.

Sphygmomanometry has been utilized in tracing the etiology of *insomnia*. Thus, it is claimed that when the latter is caused by auto-intoxication, the blood-pressure is augmented, whereas it is very low in the insomnia of neurasthenia.

Marfan[858] contends that arterial hypotension is the rule in chronic pulmonary *tuberculosis*, and that a normal or increased pressure indicates a favorable prognosis. When the tension at the commencement of the treatment is low, and is subsequently raised, the prognosis is equally favorable. Inversely, a constant low pressure portends an unfavorable course.

In the differential diagnosis between gouty and tuberculous affections of the skin or elsewhere, a high pressure argues in favor of the former and a low pressure in favor of the latter. Albuminuria is probably of renal origin if the pressure is high. In neurasthenia due to intestinal auto-intoxication the pressure is usually high, and treatment addressed to the condition will lower the pressure, whereas in neurasthenia due to actual exhaustion, the pressure is low.

In high blood-pressure due to augmented tonus of the vasomotor center (usually present in neurasthenic conditions) the bromids carried to their physiologic effects will cause such pressure to fall. When dependent on the absorption of enterotoxins, the abdominal application of the sinusoidal current for a week (daily séances of fifteen minutes) will cause a marked reduction in blood-pressure, otherwise the influence of the current is without pronounced effect. Amyl nitrite inhalations and nitroglycerin are transitory in their action in reducing pressure. Cook found that sodium nitrite is less transitory in its action, and that one or two grains on an empty stomach averages a fall of from 25 to 50 mm. Hg, coming on rapidly in from five to ten minutes, and its effects may last as long as four hours. Veratrum viride is more permanent in its effects for vasodilation than the other remedies mentioned.

The testimony of clinicians concerning pressure-figures in diseases of the *heart* are very conflicting, and I must therefore still adhere to my observations concerning this subject, and referred to elsewhere (*vide* vasomotor method of testing cardiac sufficiency). Janeway regards pressure as a means of differentiation between true and false *angina*, and observes that in the presence of a pressure above 180 mm. anginoid pain is dependent on organic disease. In chronic interstitial *nephritis* high pressure is an early and important symptom. In other renal affections the question of pressure is less important. Uremic symptoms cause a rise in pressure, and improvement spontaneous or as a result of treatment will cause the pressure to fall. In fact, many writers claim that uremic symptoms (headache, vertigo, etc.) are the result of high pressure.

In *typhoid fever* observations to be of any value must be made daily with the sphygmomanometer, just as one makes the record of the pulse and temperature. In this disease the pressure begins to fall with the development of toxemic symptoms, and one notes that this fall is progressive. The following figures of Crile are interesting: The highest pressure in 115 cases was 138 mm.; the lowest, 74 mm.; and the average, 104 mm. The average pressure in the first week of the disease was 115 mm.; second, 106 mm.; third, 102 mm.; fourth, 96 mm.; and in the fifth week, 98 mm. A rapid fall in pressure indicates hemorrhage, whereas a progressive fall suggests enfeeblement of the vasomotor centers. If perforation occurs, there is usually a sudden rise of pressure. The fall of pressure in this disease suggests the value of cardiotonic medication, which in most instances is of more value than the measures employed for reducing the temperature.

In *surgery* blood-pressure estimations are of unquestionable value. The use of ether as an anesthetic either causes the pressure to rise, to be unaffected, or in a very small proportion of the cases to fall. Chloroform, as a rule, diminishes the pressure. Peripheral operations involving irritation of nerve-endings and nerve-trunks cause a rise in pressure, and it has been suggested that sudden death following trivial operations may be caused by rupture of diseased cerebral arteries the result of a sudden increase of pressure. Hemorrhage in an anesthetized patient causes a sudden fall of pressure followed by a rise, provided the bleeding is not severe or complicated by shock. In *collapse* and shock a fall of blood-pressure is one of the most positive signs, and the fall is always in proportion to their severity. According to Crile, collapse is a sudden shock, a progressive fall of pressure, and in which the vasomotor center does not respond to stimuli. In these cases the danger exists in loss of the vasomotor and not of the cardiac function. The use of chloroform is interdicted when shock is feared and peripheral stimuli are inhibited by "blocking" large nerves by means of cocain before their division. Bishop[280] has directed attention to a constitutional condition of low arterial tension in children in whom no heart lesion exists. Such children suffer discomfort from lack of circulation (cold feet, depression, and fainting attacks). The functional heart-tests show that the heart is not compromised. Otis, of Boston, suggests that blood-pressure should be taken as a routine measure. The average blood-pressure in *tuberculous persons* is about 126, and a fall in tension is suggestive of impending hemorrhage. This latter may be warded off by ergot. In hemor-

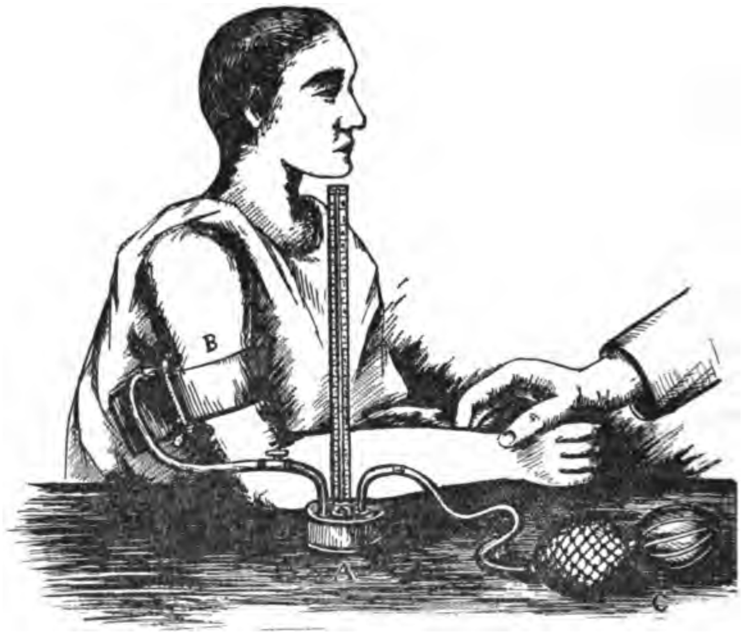


Fig. 120.—Sphygmomanometer of Riva-Rocci. *A*, manometer; *B*, arm-piece; *C*, inflating apparatus.

rhage when the blood-pressure for the individual is high, inhalations of amyl nitrite or nitroglycerin may be used internally; if low, ergotin is injected subcutaneously.

Tests for Arterial Sufficiency.

Blood-pressure.—Reference has already been made to the diagnostic significance of blood-pressure. The instrument employed for estimating pressure is called a *sphygmomanometer.* All sphygmomanometers are based on the principle of circular compression of the arm by an arm-piece, *B* (Fig. 120), connected with a manometer (*A*) and an inflating apparatus (*C*). When the arm-piece is sufficiently tight to obliterate the pulse at the wrist, the height of the mercury in the manometer indicates the maximum systolic pressure. With the instruments of Janeway and Stanton, the diastolic pressure can also be obtained. The highest pressure in the pulse-wave is the systolic; the lowest, the diastolic; and mean pressure signifies the average of systolic and diastolic pressures. For all practical purposes it is sufficient to estimate the systolic pressure, for it is more often modified by pathologic conditions than the diastolic pressure. The diastolic pressure in a normal pulse is 25 to 40 mm. below the systolic pressure, and in high tension it may be as low as 50 to 80 mm. Many circumstances modify our clinical results, and certain precautions must be taken with the use of all sphygmomanometers. All observations must be made with the patient in the same position; the arm-piece should be applied at the heart-level and should fit accurately. A wide arm-piece (12 cm.) must be employed. The connections must consist of non-distensible tubing. It is, of course, better to employ an instrument which measures systolic and diastolic pressures. Elsewhere in this work I have referred to the possible error of the observer mistaking his own pulsations for those of the patient. To obviate this error either in searching for tracheal tugging, for pulsations, or in estimating blood-pressure, I place a rubber ring at the base of my

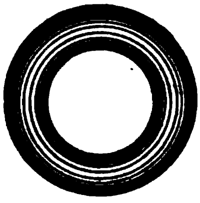


Fig. 121.—Rubber ring for inhibiting auto-pulsations. The ordinary ring used on umbrellas may be employed for a like purpose and is slipped over the finger and rests at the base of the latter.

index-finger to exclude the blood, and consequently the pulse, from the latter (Fig. 121).

Vasomotor Method (page 372) and *Vasomotor Sufficiency* (page 371).

In estimating the blood-pressure we do not usually take into account the character of the food ingested. Unless this is done, no uniform clinical observations can be achieved. Thus an excessive flesh dietary will augment, whereas a meal in which carbohydrates predominate will diminish, the pressure. Another fact of importance is the time of taking the pressure. It is now known that during the active process of digestion the hyperemia in the splanchnic area reduces the volume of blood outside of this area, which is balanced by a contraction of the systemic arteries with an increase of arterial tension. The foregoing phenomenon is normal and has been designated as the arterial abdominal reflex.

Hypertension and Arteriosclerosis.—Persistent hypertension usually coexists with arteriosclerosis, hence the diagnosis of the latter condition may furnish corroborative data of hypertension. When the blood-pressure is low in arteriosclerosis, my observations show that arteriosclerotics of this class belong to the hopeless category, insomuch as the vasomotor mechanism is either exhausted or unable to properly usurp the functions of a failing heart. It is also well to remember, according to Müller, that arteriosclerosis causes hypertrophy of the left ventricle when the splanchnic arteries or aorta above the diaphragm are very much involved, and that arteriosclerosis of the other vessels does not exert this influence on the heart. In arteriosclerosis, as a rule, the augmented peripheral resistance by increasing the work of the left ventricle causes that chamber to hypertrophy. Hypertrophy of the left ventricle, increased blood-pressure, accentuation of the second aortic sound, and a palpable induration of the arteries are characteristic signs of arteriosclerosis. It is natural that the individual symptoms will be influenced by the vascular territory involved. Thus, when the coronary arteries are implicated anginoid symptoms are frequent, and if dilatation follows the hypertrophy, all the signs of a broken compensation are present. When the renal arteries are involved, the symptoms of a contracted kidney exist. In cerebral arteriosclerosis, headaches, vertigo, transient pareses, or aphasia and hemorrhage may be present. If the arteries of the leg are involved, vasomotor changes and *claudication* are prominent signs. Although arteriosclerosis of the peripheral arteries furnishes no absolute clue to the existence of the disease in more important vascular territories like the brain, coronary arteries, and the aorta, it is nevertheless good presumptive evidence in the majority of cases. If a peripheral artery is degenerated, its rigidity may be determined by first occluding the artery with the index-finger and palpating the part below with the middle finger. The affected artery in question may be tortuous, and deposits of lime may be felt in the

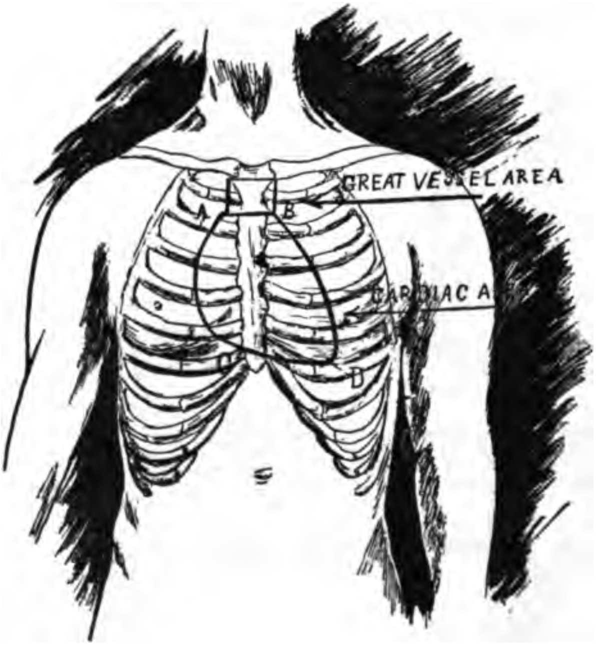


Fig. 122.—Normal boundaries of the heart and great vessels (after Butler). The upper border of the heart is projected by drawing a horizontal line across the sternum on a line with the third costal cartilages from point A (one-half inch to the right of the right edge of sternum) to point B (one inch to the left of the left sternal border). The lower border is defined by a line running from D, the apex-beat (fifth intercostal space), one-half to one inch within the mammary line to C (at the junction of the upper and middle thirds of the ensiform cartilage). A line from A to C represents the right, and from B to D the left, border of the heart. The great-vessel area may be defined by a horizontal line across the junction of the middle and upper thirds of the manubrium. This line should be three-quarters of an inch below the episternal notch and should extend to either side to permit a vertical line to be drawn from each end to points A and B.

wall as hard and rough irregularities. The softer and more elastic the vessel, the more difficult it will be to differentiate from the surrounding tissues. Not only the radial but all the accessible arteries should be palpated to determine signs of atreriosclerosis.

Groedel contends that a constant increase of blood-pressure in the absence of aortic insufficiency and of interstitial nephritis is in itself sufficient to warrant the diagnosis of arteriosclerosis.

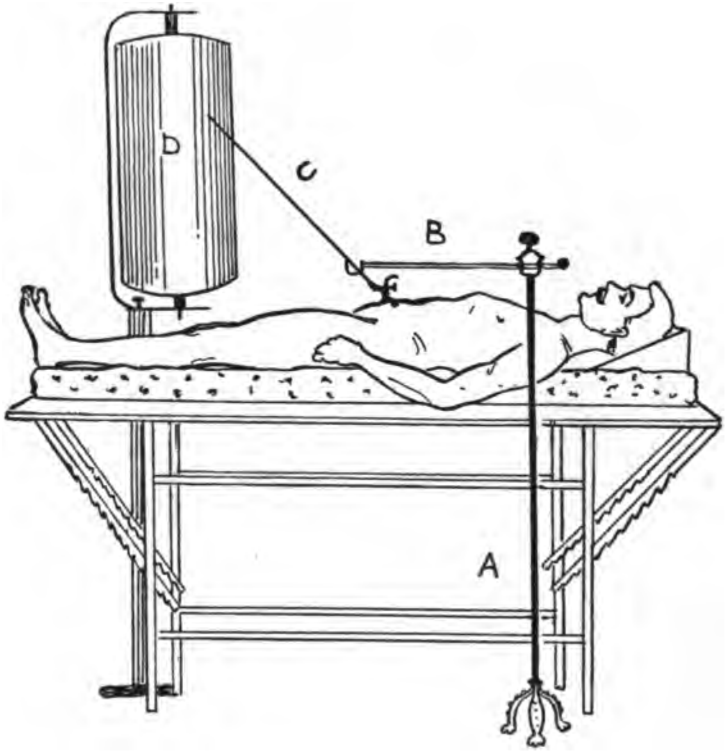


Fig. 123.—Method of taking a sphygmogram of the abdominal aorta: *A*, Stand with an adjustable rod, *B*; *C*, lever; *D*, tambour for recording.

The Palmar Sign.—This is regarded as a sign of arteriosclerosis and is observed in the palmar arch of the hands. By pressing on the radial artery so as to stop the pulse, those patients suffering from arteriosclerosis, and especially from aortic insufficiency, feel in the palm of the hand a slight sensation which they compare to the prick of a pin or the walking of a fly. Out of twenty-four subjects thus examined, in only four was the sign absent. Seven of the twenty suffered from aortic insufficiency. In healthy persons this sign could not be produced. The explanation of the phenomenon would appear to be that by the compression of the radial artery the cubital artery is congested, and this fact, with the contraction of the hypertrophied ventricle, increases the speed of the blood-current, increasing in this way the intensity of the shock in the palmar arch. Naturally, the sclerosed condition of the arteries contributes to the production of this sign.[256]

Thoracic Aorta.—Reference has already been made to the aortic reflexes (pages 631, 632), and these reflexes may be utilized in testing the caliber of the normal aorta. Reference to Fig. 122 shows the great vessel area, and if the aorta and pulmonary artery are of normal caliber, dullness does not go beyond the edge of the sternum on either side. If the dullness exceeds the border of the sternum, dilatation or an aneurism may be said to exist. Here again I must emphasize the importance of palpatory percussion, *i. e.*, to determine dullness by the sense of resistance. In this test concussion of the eighth to the twelfth dorsal vertebræ is executed. The use of the abdominal compressor (page 770) facilitates percussion of the great vessel area, and in the absence of the latter the same principle in a less efficient manner may be attained by having an assistant compress the abdominal walls after the manner employed in testing abdominal sufficiency (page 408). By either method blood is expressed from the abdomen into the heart and large vessels, filling the latter to repletion. The concussion test is preferable.

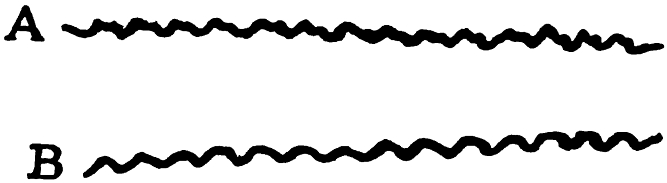


Fig. 124.—Sphygmography of the abdominal aorta: *A*, Normal tracing of the abdominal aorta; *B*, tracing from a patient with abdominal arteriosclerosis; the diagnosis was confirmed at the autopsy.

Abdominal Aorta.—By means of a simple apparatus tracings of this vessel can be taken with little difficulty, and from the sphygmogram the condition of the vessel may be determined (Figs. 123, 124). With the patient in the recumbent posture, one may observe after forcible expiration, with breathing suspended, visible aortic pulsations, which are likewise palpable. To record these pulsations, which is only possible during the time breathing is inhibited and after forced expirations, I employ an apparatus (Fig. 123) consisting of a stand (*a*) with an adjustable rod (*b*), to the end of which is attached a lever (*c*), freely movable up and down. The long arm of the lever extends 28 cm. from the fulcrum, the short arm about 3 cm. To the short arm of the lever is attached a perforated piece of metal with thumb-screw which permits of the insertion of a piece of string, to the lower end of which is attached a small coin perforated in the center. The end of the long arm of the lever is provided with a writing attachment for making the records on the recording tambour (*d*). The coin is attached to the skin of the abdomen by adhesive plaster over the course of the aorta, after the patient is in the recumbent posture. The length of the string is adjusted until the best movements are obtained in the long arm of the lever during the time breathing is suspended. After a few minutes' practice the patient can, as a rule, suspend breathing long enough to obtain an excellent sphygmogram. Reference to the normal tracing (Fig. 124) shows a slanting anacrotic limb and exaggerated predicrotic and dicrotic waves and oscillations of the katacrotic limb. Reference to the other tracing (Fig. 124), from a patient with arteriosclerosis and aneurism of the vessel, shows a slow ascent and descent, a blunt summit, and an absence of oscillations.

This apparatus may also be employed for studying rhythmic pulsations of the head, which are always present in the norm. The patient's head rests on an inflated pillow against a firm background, and the string of the short arm of the lever is fixed to the head in the occipital region. The cephalograms (Fig. 125), as I will call them, are very clear, and although I have studied them for some time in Prof. Starling's laboratory in London, and at the Collège de France with Prof. François Franck, I am unable as yet to interpret their significance, *i. e.*, I cannot say definitely whether they are of extracerebral or intracerebral origin. If they could be referred to the latter genesis, their aid in the diagnosis of intracerebral disease would prove invaluable. I have found the cephalic pulse to demonstrate a characteristic cephalogram in cerebroarteriosclerosis. Any individual wearing glasses may easily observe the cephalic pulse by the rhythmic shifting of the reflection of the electric bulb on the glasses. He must be seated with his back to the electric lamp in such a way that a reflection of the bulb on the glasses is obtained. The foregoing facts are cited with a view of inciting others to study this interesting subject.

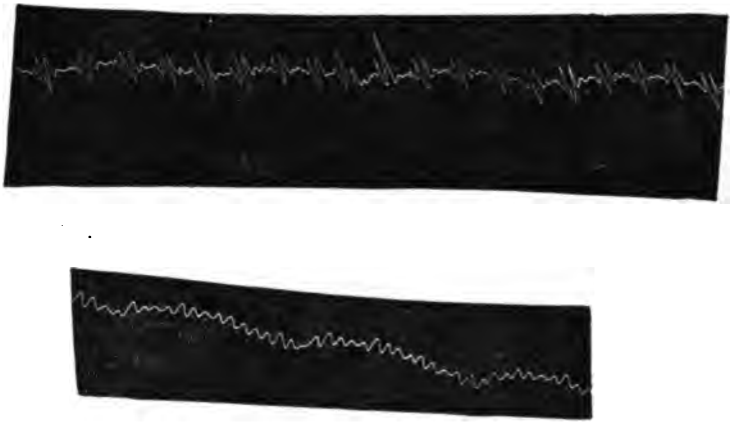


Fig. 125.—Cephalograms: Upper figure from a normal adult; lower, record from a patient with cerebral arteriosclerosis.

THE RESPIRATORY APPARATUS.

Physiology.—The *nose* is concerned in respiration, olfaction, and phonation. The respiratory function is the most important. During the passage of the inspired air through the nasal chambers, it is warmed, saturated with moisture, and deprived of coarse substances. The temperature of the air after it has passed the nasal chambers and reached the pharynx is raised to 86° F. and its humidity is raised to saturation, irrespective of the temperature and humidity of the external atmosphere. The nose is a part of the vocal apparatus which endows the voice with quality and character, and modifies it in obstruction of the nasal cavities.

The nose may be said to possess an auditory function: the Eustachian tube, which ventilates the middle ear, equalizes the atmospheric pressure on either surface of the membrana tympani, and when nasal breathing is obstructed, mouth-breathing causes the current of air passing below the nasopharynx to aspirate air from the Eustachian tube, thus diminishing the atmospheric

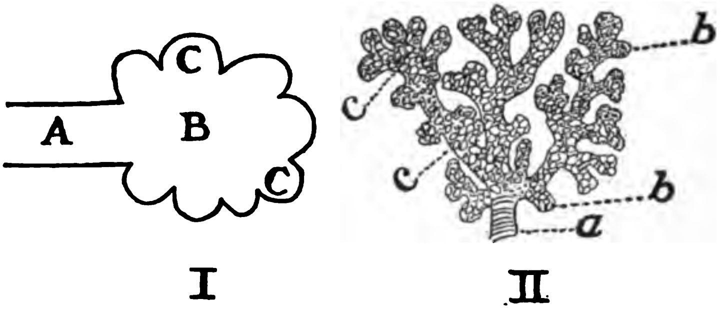


Fig. 126.—I, *A*, Terminal bronchus; *B*, the infundibulum; *C*, *C*, alveoli or air-sacs. II, Terminal branch of a bronchial tube with infundibula and air-sacs; *a*, terminal bronchial twig; *b*, *b* and *c*, *c*, infundibula and air-sacs.

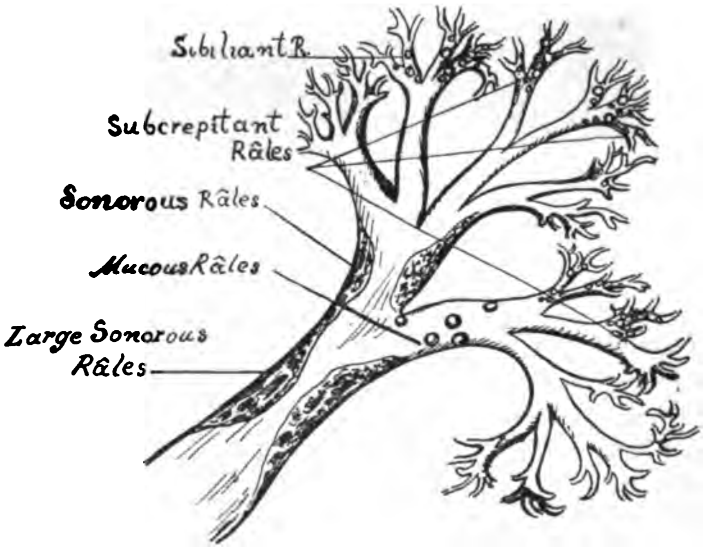
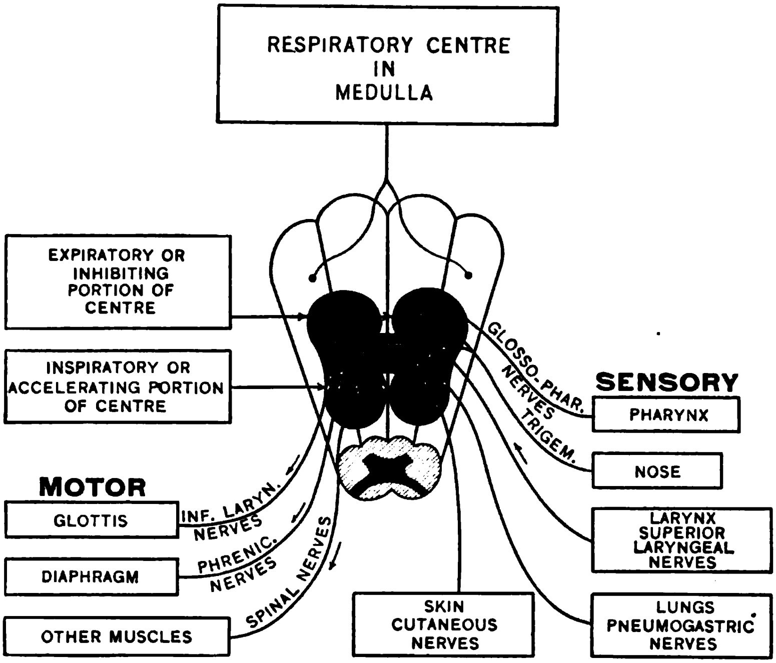


Fig. 127.—Diagram illustrating the physical signs of bronchitis.

PLATE XVI.



RESPIRATORY CENTRE IN MEDULLA
EXPIRATORY OR INHIBITING PORTION OF CENTRE
INSPIRATORY OR ACCELERATING PORTION OF CENTRE
MOTOR
GLOTTIS
DIAPHRAGM
OTHER MUSCLES
INF. LARYN. NERVES
PHRENIC. NERVES
SPINAL NERVES
SENSORY
GLOSSO-PHAR. NERVES
TRIGEM.
PHARYNX
NOSE
LARYNX SUPERIOR LARYNGEAL NERVES
SKIN CUTANEOUS NERVES
LUNGS PNEUMOGASTRIC NERVES

Fig. 128.—The respiratory center (from Butler, with kind permission of D. Appleton & Co., New York).

pressure within the middle ear. The result will be to depress the membrani tympani and reduce the acuteness of audition. It is asserted that the normal quantity of secretion of the nasal mucosa amounts to over 16 ounces in twenty-four hours.

The *larynx* provides an unobstructed passage for the entrance and exit of air. Vibration of the vocal cords by the current of expired air produces sound. The ventricular bands may vibrate to produce sound when the cords are affected by disease. Sound is produced in the larynx, and speech is sound modified by the movements of the soft palate, tongue, lips, and teeth. During deglutition, the larynx is drawn under the base of the tongue and the entrance into the larynx is diminished by contraction of the aryepiglottic muscle and the epiglottis is folded down.

The *lungs* are enveloped by a serous membrane (pleura), which consists of a visceral layer which adheres to the surface of the lung and a parietal layer attached to the inner surface of the chest-wall. Like other serous membranes, the layers form a closed sac. In health both layers are everywhere in contact, and only enough fluid is present between them to facilitate the expansion and contraction of the lungs. The lungs are made up of a number of minute parts called lobules, which are practically miniature lungs, and each consists of a terminal branch of the bronchial tube, air-sacs, blood-vessels, nerves, lymphatics, and areolar tissue. The diagram on page 794 (Fig. 126) shows a longitudinal section of a pulmonary lobule. The air-sacs are about $\frac{1}{60}$ of an inch in diameter and are lined with squamous epithelium. The *blood-vessels* of the lungs are derived from two sources: the pulmonary artery, which conveys blood for oxygenation, and the bronchial arteries, which convey arterial blood to nourish the lung-tissue. The pulmonary artery subdivides into a meshwork of capillaries which unite in four pulmonary veins which convey the arterial blood back to the lungs. The *lymphatics* freely communicate with one another and are divided essentially into three sets: (1) The subpleural, which drain the pleura; (2) the perivascular, which run among the air cells; (3) the peribronchial, in the coats of the bronchi. The lymphatics in the diaphragmatic pleura open directly into the pleural cavity by means of stomata. The bronchial lymphatic glands which receive many of the lymphatics surround the bronchi as far as their first subdivisions, and extend a considerable distance into the roots of the lungs. The ***nervous mechanism*** (Fig. 128) is made up of: (1) The respiratory center in the medulla, which consists of an inspiratory center in connection with the muscles of inspiration, and an expiratory center which controls the expiratory muscles. (2) Afferent or sensory nerves which carry impulses to either the inspiratory or expiratory center. (3) Efferent or motor nerves, which widen the glottis (inferior laryngeal), control the diaphragm (phrenic nerve), and innervate the muscles of respiration.

Respiration is made up of two acts, inspiration and expiration. Inspiration is an active and expiration a passive act, dependent on the natural elasticity of the lungs. In quiet breathing the expansive movements of the lower are greater than those of the upper part of the chest, whereas in forced inspiration the greatest movement is in the upper antero-posterior diameter. The quantity of air breathed is expressed by the following terms: (1) Tidal air, which is the amount (20 cubic inches, or 300 c.c.) changed in ordinary breathing, which by no means represents the quantity necessary to fill the lungs. (2) Complemental air is the tidal air plus the quantity drawn into the lungs in the deepest inspiration. (3) Reserve air is the tidal air plus the quantity that may be expelled by forcible expiration. (4) Residual air is the quantity of air which remains in the lungs after forced expiration.

The *respiratory movements* exert an important influence on the circulation of the blood. The pulmonary vessels are more capacious after inspiration than after expiration, therefore each inspiration widens and each expiration contracts the pulmonary vessels, and is in direct proportion to the depth of each act. It is evident, then, that the effect of each inspiration is to lessen the resistance to the blood-circuit in the lungs, a condition which favors the discharge of blood from the right heart and the outflow from the lungs. Another aid to the circulation is pulmonary suction, and is dependent on the elasticity of the lungs. Suction is more evident during inspiration, during which time the blood is aspirated from the veins of the neck and upper extremities into the superior cava and innominates, and from the abdominal veins into the inferior cava. The pulse-rate increases during inspiration and decreases during expiration, a phenomenon the explanation of which is found in cardiac inhibition which occurs during expiration. Inspiration favors the flow of lymph by diminishing the pressure of the veins. In the *chemistry of respiration* the blood parts with its excess of carbonic acid and watery vapor and receives oxygen from the alveolar air, which makes it arterial. This gaseous change is known as external respiration, in contradistinction to internal or tissue respiration. The lungs at one time were regarded as the seat of combustion, but now we know that combustion occurs in the tissues (*tissue respiration*), which take up oxygen and yield carbonic acid. The latter fact is demonstrated by injecting methylene-blue into the circulation of a living animal, which is then killed in a few minutes. The organs are colorless and the blood is found dark blue, but on exposure of the organs to oxygen they become blue; the tissues by abstracting oxygen from methylene-blue formed a colorless reduction-product, which after exposure to the air reunited with the oxygen to form methylene-blue.

Pathologic Physiology.—The protective mechanism of the air-passages is subserved: (1) By ciliated epithelial cells, which by their continual movement carry foreign substances from the bronchioles into the larynx. (2) By the mucus which becomes attached to foreign material (bacteria and coal-dust), after which it is carried away by ciliary motion. (3) Sneezing removes foreign material from the nose. Thus it is that tickling the nasal mucosa in infants will cause sneezing and thus relieves the nasal passages. (4) Coughing removes foreign material and excessive secretions.

Dyspnea.—Normal breathing is called eupnea. The ratio of the inspiratory to the expiratory act is as six to seven. Three types of respiration are recognized: the superior costal, in women; inferior costal, in men; and diaphragmatic breathing in children. In the adult male there are 16 to 24 respirations per minute. The normal relation between respiration and pulse is as 1 : 3½ to 4. It takes four times as long for the blood to go through the systemic as through the pulmonic circulation. In women the average number of respirations is 20. The younger the individual, the greater is the frequency of respirations. Position influences the number of respirations: viz., lying, 13; sitting, 19; and standing, 22 times per minute. During sleep the respirations are diminished. The respiratory mechanism (Fig. 128) is regulated by the respiratory center in the medulla oblongata, the so-called ***noeud vital*** of physiologists, which corresponds in position with the vagus nuclei. As a rule, difficult breathing is manifested by an increase in the number of inspirations with consciousness of distress in breathing. The subjective sensation of distress is necessary, for what is known as heat-dyspnea in febrile conditions, and caused by direct irritation of warm blood on the respiratory center, is not productive of distress to the patient. Any condition which interferes with a due supply of oxygen to the respiratory center conduces to dyspnea. The cause may be resident in the lungs, circulation, or brain; hence, we may speak of respiratory, circulatory, or centric dyspnea. Very often a combination of causes is present; thus, in pneumonia dyspnea is caused by pain, fever, loss of lung-function, and certain nervous factors. The respiratory area may be diminished from two-fifths to one-half before death ensues.

Respiratory Dyspnea.—General causes: diminished supply of air to the lungs, from imperfect respiration caused, *e. g.*, by the pain of pleuritis or peritonitis, weakness of the muscles of respiration, diminished elasticity of the lungs, loss of respiratory area (pneumonia, tuberculosis, etc.), lessened capacity of chest, and obstruction of the air-passages.

Circulatory Dyspnea.—Examples: anemia, cardiac inefficiency from valvular disease or myocardial weakness, superheated blood (fevers), and deteriorated blood (fevers, poisons, etc.).

Centric Dyspnea.—The Cheyne-Stokes breathing is often met with in brain diseases. It is a form of dyspnea in which periods of complete cessation from breathing (apnea) are varied with periods of slowly rising respiratory movements, which after becoming gradually deeper, become slower and shallower, until they cease altogether. This anomalous type of respiration is also observed in diseases of the heart, coma, and opium poisoning, although it may occur in health during sleep, and is normal in animals during hibernation. In the apnea period the pupils are contracted and immobile to light, and consciousness is usually lost.

In dyspneic persons the difficulty in counting the respirations may be overcome by placing the finger on the scaleni muscles (situated in the neck between the trapezius and sternomastoid muscles), which at every inspiration are raised by their contraction. By counting the elevations of the finger the number of respirations is determined. The clinician must also distinguish inspiratory and expiratory dyspnea and a combination of both. Inspiratory dyspnea occurs in paralysis of the crico-arytenoidei postici, which in health open the glottis. Expiratory dyspnea is observed when there is retarded exit of the air from the lungs, as in asthma and emphysema. Mixed inspiratory and expiratory dyspnea is the usual variety. The term orthopnea is employed when the patient, owing to the extreme distress in breathing, cannot lie down, but assumes the sitting or standing posture, and is usually present in advanced cardiac disease.

Characteristics of Dyspnea in Different Affections.—Diseases of the Larynx: The larynx is seen to rise and fall. Dyspnea is usually inspiratory and associated with dysphagia, dysphonia, and a brassy, metallic, or spasmodic cough.

Tracheal Obstruction: Dyspnea is expiratory, unaccompanied by laryngeal movements or vocal changes. A stridor is present, which is usually loudest at the point of obstruction. Retrosternal pain or oppression may be present.

Bronchial Obstruction: In obstruction of a bronchus the lung to which air passes freely becomes the seat of emphysema. The lung corresponding to the obstructed bronchus shows retarded movement and absence of vesicular respiration and fremitus, and over the root of the lung a snoring or whistling sound may be heard. Syphilis is the most frequent cause of the obstruction. If a foreign body be the cause, it usually falls into the right bronchus, which is more direct than that of the left.

Pleuritis: Dyspnea is caused in the early stages by retarded thoracic movements on account of pain, while the patient usually lies on the sound side. When effusion occurs, dyspnea is dependent on the amount of fluid present, but, generally speaking, dyspnea is less after effusion has taken place. Pulmonary and cardiac complications tend to increase the difficulty in breathing. It is well to remember that dyspnea dependent on pain only can be made to disappear by the use of a narcotic.

Pneumothorax: Dyspnea is sudden and intense, but is gradually relieved when accommodation takes place. In *asthma* the dyspnea is paroxysmal with diminished chest movements, the frequency of respiration is diminished sometimes to one-half the normal, and the rhythm is changed, inspiration being short and gasping, and expiration prolonged and associated with a wheezing sound. In *emphysema* dyspnea is common and associated with cyanosis. When the affection is moderately developed, dyspnea is only present after exertion. The contrast between the extreme cyanosis and the comparative comfort of the patient is striking. In other pulmonary and cardiac affections with a similar degree of cyanosis the patient is invariably in bed, and usually in a state of orthopnea (Osler). In *pneumonia* dyspnea is characteristic. The inspirations are short and superficial, while expiration is accompanied by a short grunt. The pulse-respiration ratio is almost pathognomonic; it may be 1 to 2, or even 1 to 1.5.

Diabetic coma may be preluded by dyspnea, which is deep, noisy, with frequent respirations. In the expired air of such patients there is a fruity odor, and the urine shows the acetone reaction with iron chlorid.

In chronic *Bright's disease* dyspnea may be caused by sudden glottis edema, effusion into the pleura, or sudden edema of the lungs. Sudden attacks of dyspnea at night, not unlike asthma, may be an expression of uremia or a chronic heart lesion. In cardiac lesions dyspnea is associated with heart dilatation, hydrothorax, or chronic bronchitis, but there is a form of cardiac dyspnea often simulating typic paroxysms of asthma (page 753).

In *hysteria* the dyspnea is "catching," such as is observed in a person on whom cold water is poured. There is no special distress and the pulse is normal. Röntgen-ray observations on individuals thus afflicted convince me that the catchy respiration is caused by a clonic spasm of the diaphragm.

Phrenic dyspnea is due to paresis of the phrenic nerves or to spasm of the diaphragm. It is usually manifest on the slightest exertion, and the patient feels as though the abdominal viscera were drawn up into the chest. The following case of phrenic dyspnea is cited in detail, because it is the first recorded case diagnosed by aid of the Röntgen rays, and it emphasized the importance of the latter in the diagnosis of thoracic diseases. I observed the case in a female, aged twenty-seven, who dated her troubles from her fifteenth year. After a severe sore throat, presumably diphtheria, she would have paroxysmal attacks of short breathing on the slightest exertion. Of late the paroxysms have become frequent, even when she is at rest. Her condition has resisted all kinds of treatment. Her affection has been variously diagnosed as phthisis, chronic pneumonia, valvular disease of the heart, etc. At night when she retires the paroxysms of dyspnea are accompanied by certain sounds not unlike the familiar hiccough. The objective examination after the conventional methods shows no anomaly of the heart and lungs. The position of the diaphragm is particularly high, especially on the right side. The *diaphragm phenomenon* of Litten is absent, although the condition of the thorax is most auspicious for its observance. There is an exaggerated costal type of respiration. During inspiration the epigastric and hypochondriac regions are drawn slightly in, whereas during expiration they are pushed outward; in other words, there is a reversal of the normal thoracic movements. The reaction of the phrenic nerves is found to be normal. After powerful galvano-faradization of the phrenic nerves, the patient is able to conduct temporary forced inspirations without any appreciable embarrassment, which before the application of the electricity was impossible. There are no stigmata of hysteria. An *x*-ray examination of the chest confirms the results of the physical examination, showing the integrity of the lungs and normal dimensions of the heart. The diaphragmatic movements are practically suspended, and this phenomenon is noted even after the patient is instructed to breathe deeply. Suddenly during the radioscopic examination the patient becomes dyspneic and is in great distress. Coincident with the dyspnea, the diaphragm on both sides, particularly the left side, is observed to contract suddenly and to descend to a distance of several inches below its normal descent, even after forced inspiration. The diaphragmatic contractions were so evanescent that it was found impossible to measure accurately the extent of the diaphragmatic excursions. These phenomena recurred frequently during the course of the examination, and were unaccompanied by the usual inspiratory sounds of singultus. During the time of the spasm of the diaphragm the patient became dyspneic and cyanotic and the epigastrium continued prominent. The diagnosis was therefore phrenic dyspnea dependent on diaphragmatic inactivity alternating with spasm of the same muscle—in other words, a neurosis of the phrenic nerves.

Paralysis of the diaphragm may occur in progressive muscular atrophy, general lead poisoning in multiple neuritis, after diphtheria, and even in hysteria. Dyspnea may be due to affections of the muscles concerned in respiration. Pain by inhibiting muscular action may conduce to dyspnea, whether the pain originates in the muscles, pleura, or intercostal nerves. The term tachypnea (or polypnea) refers to rapid breathing without evidences of dyspnea.

Respiratory Diseases and the Nervous System.—Cyanosis, which is associated with many respiratory diseases, eventually reduces the sensibility of the central nervous system, due in part to lack of oxygen supply and the toxic action of the excessive carbonic acid. Individuals thus affected show hebetude, indifference to their environment, delirium, and pass their stools and urine involuntarily. Necropsies on such persons demonstrate essentially a high grade of venous hyperemia of the brain, which accounts for the anomalous cerebration during life. The *delirium* occurring in respiratory diseases is of three kinds: (1) Febrile delirium, caused by the pyrexia and the severity of infection. (2) Delirium of inanition as a result of inanition. (3) Delirium tremens, caused by the excessive and prolonged use of alcohol.

The attacks of *syncope* frequently observed in the course of pleural exudations, when paracentesis of the exudate is attempted during the radical operation for empyema, are not caused, as Bartels contended, by obstruction of the inferior vena cava, the result of heart dislocation, but are due to the formation of thrombi in the right chambers of the heart and the superior vena cava. This thrombosis ensues in consequence of pressure of the pleural exudate on the heart, which slows the circulation. The pressure of the exudate on the lungs induces coagulation of blood in the branches of the pulmonary artery; thus emboli may be sent to the cerebral arteries, resulting in paralysis. Numerous observations in the literature show that paralysis, coma, and convulsions may follow washing of the pleural sac after empyema operations. Such paralyses have been denominated, for want of a better explanation, reflex paralyses. Von Dusch, as a result of personal investigations, demonstrated that the nervous phenomena are caused by emboli. The latter are derived from thrombi formed in the vessels of the compressed lung, which are loosened by the pressure of fluid used in washing the pleural sac. Fränkel suggests that the cases of sudden death after thoracentesis are caused by the reinflation of the lungs and the restoration of the heart to its normal situation, both of which conditions favor the dislodgment of thrombi in the pulmonary vessels. *Paralyses* occurring in the course of a pneumonia may be caused variously. An undoubted factor is acute endocarditis, which sends emboli to the cerebral vessels. Another factor is the great tendency to coagulation of the blood in pneumonia. The nervous phenomena in cerebral pneumonia are well known, and closely simulate meningitis. We now know that the pneumococcus may secondarily invade the cerebral meninges, there inducing meningitis.

Temperature.—*Pneumonia.*—It rises rapidly during the initial chill and reaches its maximum (105° F.) in about ten hours. It is of the continuous type. In persons previously debilitated, old people, and drunkards the range of temperature is lower. During the febrile period there may be a decided fall of temperature (pseudocrisis), but the temperature rises again to its former height. A high temperature may precede the crisis (*perturbatio critica*). The fever usually terminates by crisis. Slight exacerbations may follow the critical fall of temperature. Termination by lysis is usually due to some complication. Persistent fever after the fourteenth day means usually delayed resolution. A remittent, or even intermittent, type of temperature in pneumonia does not necessarily mean malarial infection. Fever occurring in alcoholic subjects often means a walking pneumonia. A continued high temperature on two or three consecutive days without remissions is a grave sign. Statistics analyzed by Fox show that the mortality is least when the temperature is 104° to 105° (7.4 per cent.); more frequent when under 103° (36.9 per cent.); still more frequent when 106° to 107° (42.8 per cent.); and most frequent in hyperpyrexia, 107° to 109°, nearly all the cases terminating fatally.

Tuberculosis.—In tubercular disease fever commences or increases in the afternoon, and gradually rises, attaining its maximum between 6 and 10 P. M. Then it gradually declines until 4 A. M. to a temperature even below the normal. Koch contends that a temperature over 100.4° in phthisis signifies septic infection. The degree of pyrexia in phthisis is always an index to the degree of lung-disintegration, and any tendency to the dissemination of the tubercular lesion is marked by a rise in temperature.

In *miliary tuberculosis* two types of temperature are observed: the continuous type and the inverse type, when the fever attains its maximum in the morning instead of the evening. Fever may be the earliest symptom of phthisis, hence in suspected cases the temperature should be taken several times a day, allowance being made, of course, for the normal thermometric range, the difference between minimum and maximum being about 1° C.; in rare instances, 2° C. Apyrexial periods indicate inhibition of the tuberculous process.

Bronchitis.—In adults as well as in children a low temperature prevails, as a rule. A sudden rise of temperature of high grade is a strong proof that the smaller tubes have become implicated (bronchopneumonia). In the latter affection the temperature is in proportion to the degree and extent of the inflammation. It is of an irregular type and falls by lysis.

Abscess of the Lung.—During the formation of an abscess the temperature may be continuous, but subsequently shows a remittent or even intermittent type.

Pleurisy.—The temperature is not typic and is rarely above 103° F., and in grave cases the temperature reaches 104° F. When the exudate becomes purulent, septic signs develop; paroxysms of fever and sweating.

Decided stress is laid on the diagnostic value of surface temperature in lung affections, although personally I can ascribe no real significance to this sign.

Urinary Apparatus.—In pneumonia the urinary secretion is not unlike that occurring in febrile affections. The chlorids are diminished or absent, but no importance can be attached to this sign. Febrile albuminuria is common. Acute nephritis may complicate or occur as a sequel. Dyspnea may be a symptom of uremia. It may occur in paroxysms or is constant, both types alternating. Occurring at night, the paroxysms may simulate asthma. Cheyne-Stokes breathing is a frequent type of dyspnea in the uremia of chronic nephritis. Dyspnea in nephritis may also be caused by edema of the glottis, by effusions into the pleura, or by bronchitis. If dilatation of the heart supervenes, dyspnea may be primarily due to that, or it may be secondary to edema of the lungs. The most frequent cause of amyloid kidney is lung tuberculosis.

Albuminuria occurring in tuberculosis of the lungs may be of febrile origin, or caused by chronic nephritis, or amyloid changes in the kidneys. A secondary tuberculous cystitis or pyelitis may cause pus or blood to appear in the urine. Hematuria, however, may result from temporary congestion. The diazo-reaction, formerly vaunted as pathognomonic of typhoid fever, also occurs in phthisis. It is especially evident when the tuberculous lung affection is acute in character. Individuals with chronic nephritis are especially liable to pleuritis and pneumonia as complications, especially if diffuse edema is present.

A *waxy kidney* may occur after empyema and bronchiectasis.

Tests for Sufficiency of the Respiratory Apparatus.

Nasal Patency.—It is important to test nasal respiratory sufficiency. Nasal obstruction may be caused by pathologic processes in the nose (rhinitis, deviations of the septum, growths, foreign bodies, etc.), nasopharynx (adenoids), and oropharynx (hypertrophied tonsils). The symptoms may be nasal and general. Mouth-breathing is one of the most prominent symptoms, characterized by dryness of the mouth, snoring at night, restless sleep, frequent attacks of cold, hoarse voice with a peculiar nasal twang, and imperfect pronunciation of "m" and "n." The condition

PHYSICAL DIAGNOSIS OF RESPIRATORY DISEASES.

DISEASE.	INSPECTION.	PALPATION.	MENSURATION.	PERCUSSION.	AUSCULTATION.
Bronchitis..........	In capillary bronchitis, inspiratory retraction of thorax.	Bronchial fremitus. Vocal fremitus normal.	Normal.	Normal.	Dry râles when fluid is viscid. Sonorous in large, and sibilant râles in small tubes. Prolonged expiration. Mucous râles when secretion is free.
Bronchostenosis	Thoracic movements on affected side diminished. Inspiratory dyspnea and inspiratory retraction of chest.	Vocal fremitus on affected side diminished.	Circumference of thorax on affected side diminished.	Normal in beginning, but soon followed by a tympanitic sound (sign of lung relaxation).	Vesicular respiration diminished or absent. Whistling or hissing sounds.
Bronchiectasis......	Flattening of affected side due to retraction of connective tissue around dilated bronchi. Inspiratory retraction of chest.	Large bronchiectases when superficial and surrounded by consolidated lung cause increased vocal fremitus.	Normal or diminished circumference.	When dilatation is superficial and large, tympanitic or tympanitic-metallic sound. Other signs of cavities. Signs absent when cavities are filled with secretion, but reappear when contents are expectorated.	Bronchial respiration with metallic sounds when cavities are superficial; otherwise vesicular respiration. Moist râles when fluid is present in cavities.
Bronchial asthma...	Expiratory dyspnea. Chest semi-distended, with little movement.	Bronchial fremitus.	Circumference of thorax increased during paroxysm.	Hyperresonance. Immobility of lung-borders. Absolute cardiac dullness diminished owing to acute inflation of lungs.	Diminished vesicular respiration and sibilant râles heard loudest during expiration. They become moist at termination of attack.

Atelectasis	Inspiratory retraction of chest, especially at its lower part. Superficial and rapid respirations.	Increased vocal fremitus when dullness is pronounced.	Circumference of affected side diminished.	Weak percussion gives dullness when airless lung is at least 2 cm. thick and 5 cm. wide and superficial.	Bronchial respiration and bronchophony when dullness is pronounced.
Emphysema........	Barrel-shaped chest and no appreciable movement on inspiration. Expiratory dyspnea. Supraclavicular region bulged on coughing.	Thoracic movements diminished. Vocal fremitus diminished owing to diminished thoracic vibration.	All diameters increased.	Hyperresonance. Liver and heart dullness diminished. Immobility of lung-border during respiration.	Respiratory sounds diminished. Prolonged expiration. Sibilant and sonorous râles.
Edema of lung	....	....	....	When amount of fluid is enough to replace air (rare), dullness. Normal when fluid is not excessive; if altered, it becomes tympanitic.	Bronchial respiration and bronchophony; when fluid is sufficient to supplant air. Crepitant and bubbling râles.
Croupous pneumonia...........	Affected side shows little movement. Respirations increased. Pulse and respiration ratio changed from 4 to 1, to 2 or 3 to 1.	Vocal fremitus increased; this is not the case when main bronchus is obstructed or when extensive infiltrations make thorax too tense.	Affected side shows increased measurement.	Tympanitic sound in first stage and resolution. When infiltration is complete, dull percussion note, but not flat, as in pleuritic exudations.	Crepitant râles in beginning of infiltration and in stage of resolution, and occurring, as a rule, only during inspiration. When infiltration is complete, bronchial respiration.
Catarrhal pneumonia...........	Dyspnea. Inspiratory retraction of chest.	Increased vocal fremitus when large lung-districts have been made airless.	....	Dullness when extensive infiltration. Dullness usually bilateral and not confined to lobes of lung, but extends alongside vertebral column.	Usual auscultatory signs of dullness when infiltration is extensive enough; otherwise moist râles.

PHYSICAL DIAGNOSIS OF RESPIRATORY DISEASES.—(*Continued.*)

DISEASE.	INSPECTION	PALPATION.	MENSURATION.	PERCUSSION.	AUSCULTATION.
Phthisis pulmonalis.............	Paralytic thorax. Frequent and shallow breathing.	Feeble expansion of chest. Vocal fremitus increased in affected portions in all stages.	Reduced circumference and expansion.	Dullness over affected districts. Tympanitic sound over cavities and cracked-pot sound if cavity communicates with a bronchus.	Harsh, jerky, or prolonged expiration. Crepitant râles over apices in early stages. Bronchial respiration and bronchophony in consolidation. Gurgling râles and cavernous or amphoric breathing over cavities.
Pleuritis sicca......	Patient lies on unaffected side. Retarded respiratory movements.	Friction fremitus. Pain on pressure in intercostal spaces. Vocal fremitus not altered.	Not altered.	Normal.	Pleuritic friction sounds, increased in intensity by pressure with stethoscope, and heard during inspiration or expiration, or both.
Pleuritis humida....	Patient lies on affected side. Respiratory movements diminished or absent. Intercostal spaces bulged. Displacement of apex-beat.	Vocal fremitus impaired or absent; fluctuation rarely felt. Dislocated organs can be palpated.	Increased circumference of affected side which is often very pronounced.	Absolute dullness altering on change of position. When fluid is small in quantity, dullness is first detected in posterior lower part of chest.	Vesicular respiration diminished or absent. Bronchial respiration, when lung has been compressed. Vocal resonance diminished or absent. Pleuritic friction sounds above exudation and at time of resorption.
Pneumothorax and hydropneumothorax	Affected side bulged, with obliteration of intercostal spaces. Apex-beat dislocated. Movements of affected side diminished.	Vocal fremitus diminished or absent. When fluid is present, splashing sound on shaking patient.	Affected side shows increased measurement.	Over fluid, dullness; above, same clear or tympanitic sound. Heart's dullness dislocated toward sound side.	Succussion sound, and metallic tinkling. Absence of vesicular breathing. Amphoric respiration when perforation is not closed.

known as *aprosexia* (mental depression, loss of energy, and mental retardation) is often associated with nasal obstruction. It is well known that *adenoids* will modify the form of the face (adenoid face), but the fact is not generally recognized that anterior nasal obstruction is responsible for facial deformities. Parsons[234] observes that variation in intranasal air-pressure is potent enough cause, when acting on moldable bones, such as are found in the lymphatic, rickety, or other diatheses accompanied by malnutrition. An anterior obstruction is at each inspiration productive of negative air-pressure within the nasal chambers, and a corresponding increase of pressure on the outside of the face, while a posterior obstruction—that is, one situated in the nasopharynx—cannot exert any influence to diminish the air-pressure in the nose and its accessory sinuses. On the contrary, this pressure is common with the general air-pressure outside the nasopharynx (and if buccal respiration be also impeded outside the lungs) and must become excessive, and its effect would be to depress the bridge of the nose and to widen it. Mouth-breathing may persist after the removal of adenoids, and is often due to hypertrophic rhinitis.

Nasal breath pictures (*spirographs*) may be obtained by condensation of the aqueous vapor exhaled through the nostrils on a cool surface. For this purpose I employ a square piece of ground-glass, which is held in contact with the upper lips and the patient is instructed to breathe in the usual way with the mouth closed. The condensed vapor on the glass may be circumscribed with a pencil and then transferred to tracing-paper as a permanent record.

Insufficient development of the lungs caused by nasal obstruction is easily determined by means of a spirograph (Fig. 129). Rhinometry or functional examination of the nose may also be determined by Glazel's mirror, which is a plate of nickeled metal, the surface of which is laid out in arcs of circles, by which the area of the vapor-spots can be measured. Nasal anomalies must never be ignored as a possible cause for many reflex disturbances. Dixon and Brodie demonstrated that the vagus contained broncho-constrictor and dilator fibers. Auld, in "The Lancet" (Oct. 17, 1903), observes that the author demonstrated seven years before by a simple clinical observation the same fact; and the latter was noted after irritation of the nasal mucosa. Now, many cardiopulmonary neuroses may be inhibited by nasal cocainization, thus directing attention to their nasal genesis. I have several times temporarily arrested arhythmia by anesthetization of the nasal mucosa, and the patients were eventually cured by some slight nasal operation. It may also be shown that cardiac enfeeblement is not infrequently a neurosis of nasal genesis.

Nasal Filtration.—Many nasal and respiratory affections could be prevented by a simple contrivance such as Heath[235] recommends for the relief of hay-fever. Heath uses a small appliance (Fig. 130), which fits in the nostril, the purpose being, so to speak, to filter the air as much as possible without interfering with respiration. This appliance consists of two rings connected by a small band. Over these rings is stretched fine grass linen or chiffon (silk). It was found that to get the best results this material must have a fine mesh (one hundred or more threads to the inch). These two rings are placed one in and across each nostril, perhaps a half an inch from the external opening, and so placed that all air respired must pass through the grass linen, chiffon, or whatever fabric may be used. They do not interfere with respiration and can be worn very comfortably. One man wore his continually for twenty-four hours, at business and during sleep. These rings were used in a number of severe cases of hay-fever, and in every one

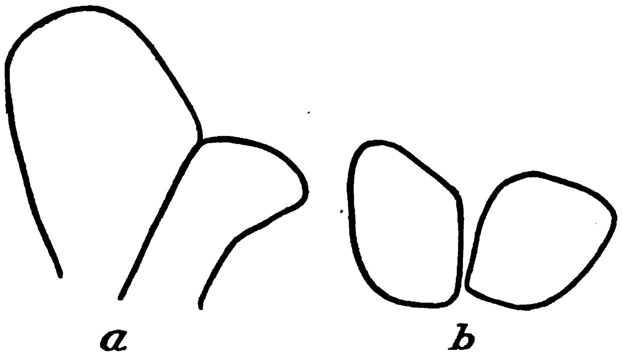


Fig. 129.—Spirographs: *a*, Left nasal passage normal, whereas the right passage is obstructed; *b*, both nasal passages obstructed.

relief was apparent in from fifteen minutes to an hour. Sometimes the appliance was difficult to use if the patient began when his nose was so blocked that he could not breathe through it at all; if, in such a case, however, the patient will persist until he can establish nasal respiration to a sufficient degree, the nasal irritation passes away very rapidly. This appliance was tried on patients who used other approved remedies (pollantin and adrenalin) without success. This appliance was suggested to Heath by noting the relief which some patients obtained at night by breathing through a wet handkerchief placed over their faces. The rings which hold the filtering fabric are usually made of German silver.

It is not necessary to have the two rings connected by a bridge, except that in this way it makes it easier for the patient to insert and to remove the rings. When the appliance is made in this way and is in position, there is a small band or wire passing across the septum where the septum joins the upper lip. This is hardly noticeable. The rings are so made that fresh grass-linen or chiffon can be applied whenever desired, this fabric being put on the rings in the same way that linen or cloth is put on the embroidery hoops used by women in their fancy-work. This filtering fabric, when in use soon becomes moistened by the secretions of the nose, but this adds much to the filtering power of the appliance; the moisture aiding the filter in holding back any pollen or substance suspended in the inspired air.

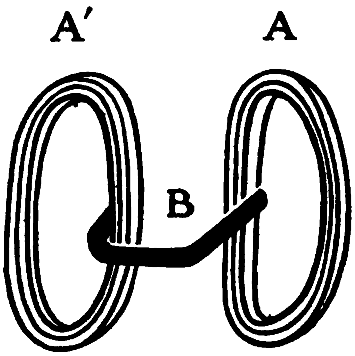


Fig. 130.—*A′*, two rings or hoops, one within the other, on which the cloth or filter is stretched for right nostril; *A*, the same for left nostril; *B*, small connecting nose-piece or bridge to be used as a handle when inserting or removing rings.

Thoracometry.—It is usual to take the circumference of the chest at the line of the nipples in front, and just below the angles of the scapulæ behind, care being exercised that the tape passes around in a horizontal line while the arms are held horizontally. The average circumference in men is 34.3 inches (Otis) and in women, 29.5 inches (Wood). The chest-expansion is determined by measuring at the time of full inspiration, and again during extreme expiration, the difference representing the chest expansion. The average in men of twenty years is, for expiration, 32¾ inches; and for inspiration, 35⅝ inches; and the chest expansion, 2¾ inches (Fröhlich). In taking the semi-circumference of the chest, make a vertical mark in the median line of the sternum, and another on the vertebral spinous processes at the line of the nipples. With the tape each half of the chest is measured. In right-handed individuals the right exceeds the left half of the chest by about half an inch. The expansion of both halves of the chest is similarly determined. To measure the diameters of the chest, calipers are used and the nipple-line is selected. The transverse diameter of the chest in men is about 9.9 inches and the antero-posterior diameter 7.5 inches.

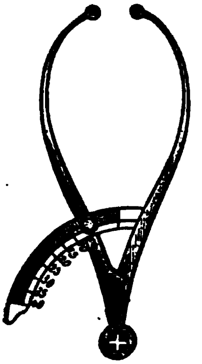


Fig. 131.—A convenient instrument for measuring the diameters of the thorax.

Cyrtometry.—A simple apparatus for determining the shape of the chest consists of two bands of lead connected by a small piece of rubber tubing. The rubber tubing permits of the separation of the bands of lead without altering their shape. After the lead is molded to the contour of the chest-wall, it is removed and laid on a sheet of paper, and after the sternal and spinal points are marked, the inner border of the bands is outlined with a pencil.

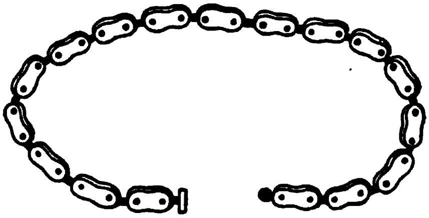


Fig. 132.—Cyrtometer.

Pneumatometry.—This is a method of measuring the force of inspiration and expiration by means of a mercurial manometer (pneumatometer). It shows that the power exerted in expiration is greater than in inspiration. The inspiratory power is diminished in phthisis, stenosis of the air-passages, and pneumonia. The expiratory power is diminished in emphysema, asthma, and bronchitis.

I frequently test the expiratory force, which is deficient in asthma and emphysema, by noting the distance at which a candle may be extinguished by the patient. As an exercise for asthmatics, this method achieves excellent results in toning the enfeebled bronchial musculature (longitudinal fibers); gradually the candle may be extinguished at a greater distance, and, as the latter is increased, the paroxysms are improved.

Spirometry.—By means of an instrument called the spirometer (Fig. 134), the vital capacity of the chest is determined as indicated by the quantity of air which a person can expel from his lungs by a forcible expiration after a very deep inspiration. The quantity of air represents the tidal, complemental, and reserve air, and is about 225 to 250 cubic inches (3500 to 4000 c.c.) in the adult measuring 5 feet and 7 inches in height. For every inch of height above this standard, the capacity is increased by 8 cubic inches, and for every inch below, it is diminished by the same amount. The vital capacity of an adult man to that of a woman of the same height is as 10 to 7.

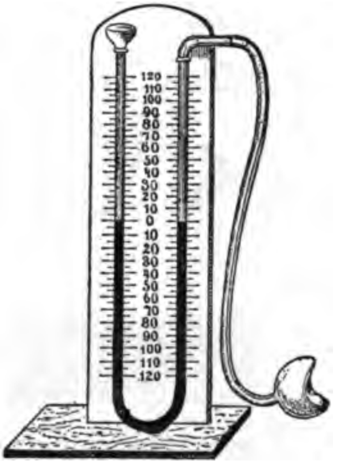


Fig. 133.—Pneumatometer.

Vagus Influence.—It has already been shown how the broncho-dilator fibers of the vagus may be reflexly influenced (page 498). If the Tucker remedy or the Bertram substitute (page 217) to which is added 3 per cent. of cocain is sprayed into the nose, the lung resonance obtained by percussion is translated into dullness or a flat percussion note. This is the lung reflex of contraction, and is dependent on reflex irritation of the broncho-constrictor fibers acting on the bronchial musculature. The more pronounced this reflex, the more marked is the dullness on percussion. It is present (lung reflex of contraction) even in asthmatics, but less evident than in the normal subject.

For other tests, *vide* Respiratory Gymnastics (page 501) and Tracheal Traction Test (page 305).

In connection with the tracheal traction test, I wish to refer to this sign as an aid in auscultation. One notes that very often in bronchitis the râles are not pronounced, and this is especially the case in auscultation of the lung-apices in early phthisis. If the neck is stretched after the manner of provoking the traction test, râles previously audible are accentuated and râles previously absent become audible. The maneuver in question provokes a contraction of the entire bronchial tree. Parker,[276] in an exhaustive and thorough contribution, which should be consulted, attributes common *alopecia* to a double cause, one being the remote or fundamental cause represented by the absence of upper-chest breathing, a condition that allows a poisonous substance to develop in the lungs; the other, the direct or exciting cause, represented by the

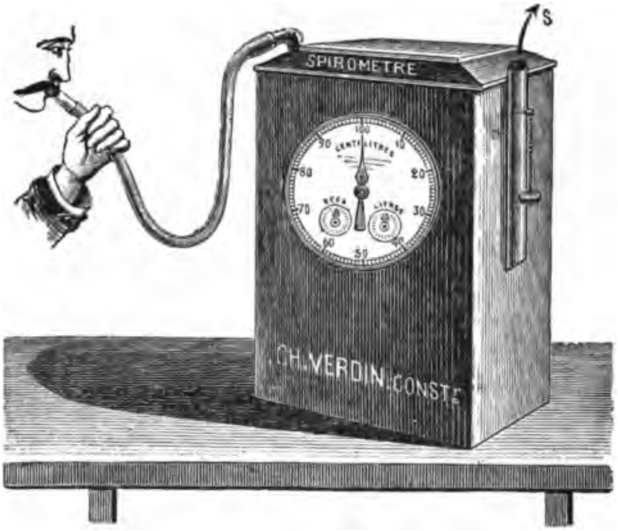


Fig. 134.—Spirometer.

effect produced by this poisonous substance circulating in the blood.

THE GLANDULAR ORGANS.

It is not a difficult physiologic problem to determine the functions of a gland possessing a duct, but there are a number of ductless glands (spleen, thymus, thyroid, etc.) which yield what is known as an internal secretion, which leaves the gland either by the veins or lymph-vessels to be distributed to different parts of the body. Even the glands with ducts (liver, pancreas, and kidney) yield an internal as well as an external secretion. Aside from the internal secretion of the ductless glands, there is an auto-intoxication theory which supposes that the gland subserves an excretory rather than a secretory function by destroying harmful products, and that when the gland is removed or its function in any way compromised, the waste products accumulate in the organism and exert their baneful effects. Certain glands, like the carotid, which is situated on either side at the point of bifurcation of the common carotid artery, and the coccygeal gland, in front of the tip of the coccyx, have no known function. The pituitary body, or hypophysis cerebri, lying at the base of the brain in the sella turcica, yields an extract which causes a rise of blood-pressure. In acromegaly this gland is enlarged, but it is impossible to say at present whether this disease, like gigantism, is associated with an excessive or a deficient action of the pituitary body. No definite results have been attained from the use of the pituitary substance. The pineal gland is situated on the back part of the corpus callosum and contains deposits of earthy salts (brain-sand).

Suprarenal Glands.—These triangular bodies rest on either side upon the upper border of the kidney. Removal of these glands is rapidly fatal in animals, and affections of the glands in man are followed by the acute symptoms of Addison's disease, viz., muscular weakness, loss of vascular tone, and nervous prostration. Pigmentation of the skin is not noted in animals. Reference has been made to the investigations of Josué in 1903, and confirmed later by others, of arterial degeneration provoked in rabbits by the various adrenalin preparations. Miles[332] has investigated the subject in an entirely new direction, and shows that arteriosclerosis is frequently found in normal rabbits; thus, of sixty-one rabbits that had received adrenalin, 28 per cent. showed arteriosclerosis, whereas similar lesions were found in 34.5 per cent. of normal rabbits which had not received injections of adrenalin. Concerning the physiology of these bodies, *vide* page 336, and the tests for suprarenal insufficiency, page 338.

Thymus Gland.—Like other lymphoid tissues, this gland assists in producing colorless corpuscles. It persists throughout life in hibernating animals, and at each period of hibernation it enlarges and becomes laden with fat. In the frog it likewise persists throughout life, and its removal is followed by muscular weakness, paralysis, and death. Intravenous injections of thymus extracts reduce blood-pressure and accelerate the heart. The diagnostic value of the thymus substance has already been discussed (page 346).

Thyroid Gland.—This gland consists of two lobes on either side of the trachea, connected by a middle lobe or isthmus.

The **parathyroids** are small bodies (usually four) located either in the neighborhood of the thyroid gland or embedded in its substance. Many regard these glands as more important in function than the thyroid gland.

Regarding the therapeutic action of thyroid preparations, *vide* pages 346, 347. There reference is made to the various uses of the thyroids. More recently thyroid inadequacy is regarded as an etiologic factor in chronic urticaria, for which thyroid extract in many cases is regarded as a specific (Ravitch).

We will next discuss the more important glands possessing ducts.

THE LIVER.

Physiology.—This is the largest gland in the body, and receives its blood from the portal vein and the hepatic artery, and by means of the hepatic veins the blood is returned into the inferior vena cava. The bile secreted by the liver is conveyed directly into the intestine during digestion by the hepatic duct, or into the gall-bladder by the cystic duct, where it is stored for future requirements. The hepatic artery carries blood destined for the nutrition of the hepatic structures, whereas the portal vein collects blood from the stomach, intestine, spleen, and pancreas. The blood in the liver is increased during digestion (physiologic hyperemia). The amount of bile secreted daily varies from 500 to 1000 c.c. The physiologic stimulant of the biliary secretion is the presence in the intestine of semidigested food (chyme). Proteid food increases the secretion of bile, because the digestive products carried by the blood to the liver stimulate the hepatic cells. Fatty food, on the contrary, has no such action, because it is absorbed by the lacteals and not by the portal vein. Some regard the bile as merely excretory, others claim that it has a slight action on fats and carbohydrates, and practically all agree that its principal action is asserted in the presence of the pancreatic juice, especially in the digestion of fat. Bile has always been regarded as a natural antiseptic, but the bile is easily putrescible, hence if it diminishes putrescence in the intestine, it does so by hastening absorption, which diminishes the quantity of putrescible material in the bowel.

The glycogenic function of the liver is very important. By *glycogenesis* is meant the property possessed by the liver of forming glycogen from carbohydrates, and this glycogen is stored in the liver, but can be converted, as the system requires, into sugar (glucose). Glycogen may also be formed from proteid food, but is probably never produced from fat. According to the original theory of Claude Bernard, when the percentage of dextrose in the blood exceeds its normal level, equal to about 0.15 per cent., the excess of sugar, by stimulating the liver-cells, causes the latter to transform the circulating sugar into glycogen, and thus maintain the normal percentage of sugar in the blood. If, however, the percentage of sugar in the blood is below the normal, a reverse stimulus causes the hepatic cells to transform the glycogen into soluble dextrose.

It was formerly supposed that urea was formed in the kidneys, but experiments demonstrated that urea accumulated in the blood and tissues even after removal of the kidneys. The prevailing theory supposes that urea is formed in the liver. After the removal of the liver in animals like frogs, the formation of urea is practically abolished, and in degenerative changes in the liver urea formation is diminished or almost absent (acute yellow atrophy).

In the norm the poisonous substances in the gastro-intestinal canal are either not absorbed, or, if they are, they are made innocuous and rapidly excreted. Auto-protection of the organism against self-poisoning is achieved by organs which either arrest or transform the poisons or eliminate them. The *organs of defense* practically represent the bodily resistance. This, equationally expressed for germ infection, is applicable to auto-poisoning, viz.:

$$D = \frac{PTA}{R}$$

D, the disease, equals P, the poison, multiplied by T, its toxicity, multiplied by A, its amount, the product being R, the resistance of the individual attacked. The liver is unquestionably the chief organ of defense. It converts the poisons into non-toxic and assimilable substances, filters them, and excretes them in the bile. When the liver-function becomes insufficient, the poisons destined for destruction enter the blood, and the clinical picture of hepatic toxemia results. If the liver is excluded from the general circulation by connecting the portal vein with the inferior vena cava, nervous manifestations and even death may follow the ingestion of meat.

Pathologic Physiology.—We have partially discussed the pathology of diabetes (page 117). It has been shown that strict attention to diet may benefit the diabetic condition, but in serious cases diet is without any influence. It is assumed that in the latter cases sugar is derived from the metabolism of the proteid constituents of protoplasm. Diabetes includes many pathologic conditions, but the feature common to all is an excess of sugar in the blood and urine. In animals diabetes may be evoked in a variety of ways:

1. By injury to the floor of the fourth ventricle near the vasomotor center, and thus it is that affections of the brain may be associated with glycosuria.
2. By extirpation of the pancreas (*vide* pancreas).
3. By the administration of phloridzin. We have already noted (page 90) that many drugs can produce glycosuria, but phloridzin is the most powerful of all drugs in this respect (*vide* kidney).

Gall-stones are formed in the gall-bladder, and are usually composed of cholesterin and the calcium salt of bilirubin. The constituents of the bile are precipitated to form calculi by conditions which produce biliary stagnation and infection. Thus it is that in women, in whom calculi are frequent, lacing and pregnancy, which change the direction of the biliary tract, conduce to biliary stasis by pressure. In advanced age atrophy of the musculature of the biliary passages likewise conduces to stasis by inhibiting the flow of the secretion. Normal bile is sterile, but the gall-bladder is a favorable habitat for all kinds of micro-organisms, which are carried there by the portal vein, or they enter by way of the common duct. In infectious diseases, like typhoid fever and pneumonia, bacteria are likely to be found in the bile, and micro-organisms have been discovered in the center of gall-stones. Among the symptoms associated with gall-stones are colic and fever. The pain is caused by passage of the stone, by the acute inflammation associated with a paroxysm, or by distention of the gall-bladder by retained secretions. Fever associated with stones is due to septic infection of the bile-passages. In other instances the fever may occur with every attack for years, and is known as hepatic intermittent fever (chills, fever, and sweating). When the stone obstructs the cystic duct, the gall-bladder may become dilated (*hydrops vesicæ felleæ*) and become so large as to occupy the greater part of the abdomen, as in the case reported by Tait. In these instances of enlarged gall-bladder Riedel has directed attention to a tongue-like projection of the anterior margin of the right lobe of the liver. Jaundice in these cases is not necessarily present.

Courvoisier's Law.—In cases of chronic jaundice due to obstruction of the common bile-duct a contraction of the gall-bladder signifies that the obstruction is due to a stone: a dilatation of the gall-bladder, that the obstruction is due to causes other than stone. The law of Courvoisier is based on the fact that in cholelithiasis the gall-bladder is the site of chronic inflammation, and is, in consequence, contracted and not capable of dilatation. Hence palpation of an enlarged gall-bladder excludes cholelithiasis and argues in favor of a neoplasm. Naturally this law does not hold good if the growth has its origin in the gall-bladder. According to

Moynihan,[254] there is considerable evidence to prove the correctness of the foregoing statement, but the law may be violated under the following circumstances: (1) Where there is a stone or stricture in the cystic duct causing dropsy or empyema, together with the acute impaction of a stone in the common duct. (2) Where there is a stone in the cystic duct pressing upon the common duct. (3) Where there is distention of the gall-bladder by an acute inflammatory process, with obstruction of the common duct by stone. (4) Where there is chronic induration of the head of the pancreas, with a stone in the common duct. (5) Where there is malignant disease of the common duct at any part of its course, or cancer of the head of the pancreas and a chronic sclerosing cholecystitis. The violations of the law constitute about 10 per cent. of all cases, but they rarely cause difficulty in diagnosis when the other symptoms are taken into consideration.

Jaundice may be either obstructive or toxemic. The obstructive form is caused by any condition which interferes with the passage of bile from the liver into the intestine, and as a result the bile is absorbed by the hepatic vein and conveyed into the general circulation. Such obstruction is frequent in gastro-duodenal catarrh, and may also be caused by obstruction of the duct by tumors of the liver or neighboring organs, by gall-stones or round-worms in the common duct, or by growths or strictures of the duct itself. Toxemic jaundice is caused by poisons in the circulating blood which destroy the red corpuscles. Such poisons are toluylendiamin, arsenic, phosphorus, snake-venom, and infections such as pyemia, malaria, yellow fever, etc. Icterus occurring in such conditions was formerly called hematogenous icterus, but now it is believed that jaundice is always of hepatic origin. The poisons in question destroy the blood by hemolysis, with a liberation of hemoglobin and increased formation of bile-pigments. The bile becomes viscid, which causes temporary obstruction with consequent reabsorption of bile and icterus. A hereditary form of icterus has been described as a familial disease. Icterus neonatorum occurring in about 60 per cent. of all new-born infants is imperfectly understood, but is supposed by Quincke to be caused by the resorption of bile from the intestines. It has been noted that after birth the blood from the intestines may not pass through the liver, but passes into the general circulation from the portal vein by way of the ductus venosus. Aside from the just described physiologic icterus, there is a severe form occurring in the new-born which may be caused by syphilitic hepatitis, by absence of the common or hepatic duct, or by sepsis in connection with phlebitis of the umbilical vein. In acute yellow atrophy of the liver there is intense jaundice associated with cerebral symptoms caused by necrosis of the liver-cells, with diminution of the liver-volume.

In icterus the yellow discoloration is first manifested in the *conjunctivæ scleræ* and in other mucous membranes and where the skin is thin. An object-glass applied with slight pressure to the lips will render the latter anemic, and through the glass the yellow color will become more evident. The color varies according to the intensity of the icterus. It is light yellow in mild, and green or brownish-green in severe, forms (*icterus viridis* and *melasicterus*). Icterus cannot be detected by gas- or lamp-light, but if observed through a violet sheet of glass or gelatin, yellow is seen as a dark yellow. Subconjunctival fat must not be mistaken for icteric coloration. Santonin or picric acid and its salts may cause a yellow discoloration of the skin. The yellow skin in the commencement of icterus is produced by the biliary pigments in the blood-plasma. Later the cells of the rete Malpighii imbibe the pigment, which fact accounts for the continuance of the icteric coloration after the immediate cause is removed. According to Posselt, even a trace of bile-pigment in the blood may be demonstrated by drawing a drop of blood into a U-shaped capillary, about 9 cm. long and 1 mm. lumen, warming the tube and then centrifugalizing. A canary yellow or lemon tint in the supernatant serum is an index of the presence and proportion of bile-pigment in the blood. This method is especially applicable in the early diagnosis of jaundice. The symptoms peculiar to icterus are: Itching of the skin, minute cutaneous hemorrhages, slowing of the pulse due to toxic paresis of the cardiac ganglia, yellow vision (xanthopsia), and nervous symptoms (delirium, coma, convulsions, etc.) due to cholemia. The pigment appears in the urine and sweat and rarely in the saliva.

Hepatic Toxemia.—Hepatic disease, especially in the later stages, even without the presence of icterus, may be associated with a variety of toxic symptoms connected with the nervous system (stupor, delirium, convulsions). Fever is also a frequent symptom. In such cases we assume a degeneration of the hepatic cells to exist, but beyond this our knowledge does not extend. Hepatic toxemia bears some resemblance to uremia and diabetic coma. The condition known as cholemia (page 294) is a form of hepatic toxemia.

Circulatory Disturbances.—We have already noted that there is a physiologic congestion of the liver during digestion, but in persons who eat and drink to excess this congestion may become pathologic, and may even conduce to organic change. The fullness or distress in the right hypochondrium, to which reference is frequently made by dyspeptics, may be caused, as Osler suggests, by hyperemia of the liver. The amount of blood contained in the liver is equivalent to one-fourth the amount of blood contained in the body. During digestion this amount is very much increased, hence the drowsiness after eating, especially in dyspeptics, the result of brain-anemia from portal congestion and the cold extremities and chilly sensations. Hyperemia of the organ has been noted in suppression of the menses. The Germans speak of hemorrhoids as "*Goldader*," and it has been noted that arrested bleeding from hemorrhoids has been followed by hyperemia of the liver. Even mild grades of liver enlargement may be detected by executing the method of percussion described on page 514.

Passive congestion is frequent in all conditions leading to venous stasis in the right ventricle of the heart, and is associated with swelling of the organ. If the congestion persists, the connective tissue of the liver is increased, and may subsequently be followed by contraction of the organ. In passive hyperemia pulsations of the liver may be encountered, and may be palpated if one hand is placed on the ensiform cartilage and the other upon the margin of the ribs on the right side. When the portal vein is obstructed, as in pylephlebitis or in the cirrhoses of the liver, a compensatory circulation is established. Primarily, however, the overloaded vessels of the stomach and intestines conduce to bleeding from the stomach, bowels, and esophagus (varices). Catarrhal gastro-intestinal symptoms are frequent. The spleen is enlarged and ascites is a common symptom. When the collateral circulation begins to be established, one may observe hemorrhoids and enlarged epigastric and mammary veins. In all cases of intra-abdominal venous congestion the intra-abdominal pressure is usually increased. This is especially so with reference to the upper abdominal region. In the norm the distance between the xiphoid process and the navel (*linea xipho-umbilicalis*) equals the distance from the navel to the incisura pubica (*linea umbilico pubica*). In congestion the linea xipho-umbilicalis is greater than the other line and the resistance of the upper abdomen is very much increased. If the patient suffers from heart-symptoms or dyspnea dependent on increased abdominal pressure, such symptoms are intensified by pressure exerted anywhere in the xipho-umbilical line. Pressure with the finger in the latter line produces a persistent dark red spot, and not, as in the norm, a localized anemia. The veins of the abdominal wall are distended, and at the points of the insertion of the diaphragm one may note a circular band of very small cutaneous blood-vessels, from which the blood is only feebly expressed by pressure.

TESTS FOR HEPATIC SUFFICIENCY.

Transmitted Palpation.—In his book on "Splanchnic Neurasthenia" the writer has endeavored to show that enlargement of the liver is an almost invariable accompaniment of this affection. The liver on palpation is exquisitely painful. It is more painful after eating, and the sensation of fullness after a meal is caused by hepatic engorgement. This hepatic tenderness, which is an evidence of insufficiency of the organ, is associated with neurasthenic symptoms, to designate which I have coined the word *toxico-neurasthenia.*

Congestion of the liver compromises its functions, and, as already remarked, congestion and "hepatic inadequacy," as Yeo calls it, coexist. It is not always an easy matter to palpate the organ, hence transmitted palpation may be employed, supplemented by sinusoidalization for diagnostic purposes (pages 477, 823). The same method is applicable in the examination of the kidney. According to *Jordan Lloyd's symptom,* percussion over the kidney in stone of this organ causes pain in the loin, even when pressure is painless.

The Liver Reflex.—This reflex, first described by the author, is dependent on contraction of the muscular fibers contained in the fibrous coat of the liver which enters the organ with the branches of the portal vein. It is elicited as follows: First determine the position of the lower border of the liver by percussion; then with a pleximeter placed anywhere in the hepatic region strike it a series of vigorous blows with a strong percussion-hammer; percuss again, and, in the norm, it will be found that the lower border of the liver will have receded from one-half to one inch. This reflex may last as long as four minutes. This maneuver is also an excellent one for exercising the liver, insomuch as indican may be demonstrated in the urine, although previously absent, or increased if already present. If a given dullness is caused by the liver, the liver reflex can be demonstrated. This latter fact is important in the diagnosis of abdominal tumors.

Cholemia.—This condition is provoked by the absorption of bilirubin which should have been eliminated into the intestine with the bile. Two-thirds of the toxicity of the bile is supposed to be due to bilirubin, and in the average subject suffering from hepatic insufficiency is the underlying cause of the symptoms. Examination of the urine for bilirubin in cholemia is usually without result, but an examination of the blood is more trustworthy (page 294).

Urine.—All evidence tends to show that urea and uric acid are formed in the liver, hence these substances are diminished in the urine (hypoazoturia). In estimating the urea in the urine, we must remember that its percentage varies with the amount of proteid food ingested, hence, before concluding that hypoazoturia is present, an ample mixed diet must be given. If a patient, according to Hirschfeld, ingests during one day a test diet of 500 grams of meat, 8 eggs, and 200 grams of bread, which represents a total of 172.25 grams of proteid, he will normally excrete 59 grams of urea.

In the quantitative determination of urea Hind's modification of the Doremus ureometer may be used. The specific gravity of the urine, however, will give an approximate idea of the percentage of urea, provided no sugar is present. Thus, a specific gravity of 1014 corresponds to about 1 per cent. of urea; 1014 to 1020, to about 1.5 per cent.; 1020 to 1024, 2.25 per cent.; and 1028, to about 3 per cent. This estimate is modified in fever and in cachexia owing to the diminished chlorid excretion. Another method for estimating the quantity of solids excreted in twenty-four hours in 1000 parts of urine is to multiply the last two figures of the specific gravity by 2. Thus, if in twenty-four hours there are 1500 c.c. of urine with a specific gravity of 1017, the calculation would be: $2 \times 17 = 34$ grams in 1000 c.c., and in 1500 c.c., $34 + 17 = 51$ grams. About 50 grams of solid matter is excreted in twenty-four hours, and one-half of this consists of urea and one-fourth of sodium chlorid.

Another method is to collect the urine of twenty-four hours and note the number of ounces passed; multiply the number of ounces by the last two figures of the specific gravity and add to the product one-tenth of itself. Thus, if 50 ounces were passed with a sp. gr. of 1020, the calculation would be: $50 \times 20 = 1000$; and $\frac{1}{10}$ of $1000 = 100 + 1000 = 1100$, the approximate number of grains of solid matter. This would be normal for an individual weighing about 130 to 140 pounds. A diminished excretion of urea is accompanied by an augmentation of ammonia, uric acid, leucin, and tyrosin, because these bodies are all transformed into urea by the liver. The quantitative estimation of ammonia in the urine is a complicated process and not easily executed by the practitioner. Leucin and tyrosin are detected by evaporating the urine to about one-tenth its volume and then adding a little alcohol. The needles of tyrosin and the nodules of leucin are recognized microscopically.

The Glaessner test[370] for measuring the functional capacity of the liver is founded upon the fact that the normal liver can convert 20 to 25 gm. of amino-acids into urea and the latter is excreted in the urine. When the functioning capacity of the liver is implicated, the excretion in the urine occurs in the form of amino-acids, and the amount of nitrogen excreted in this way can be estimated by suitable tests. Glaessner found that in the norm no amino-acids were excreted, but all of them were converted into urea. In pneumonia, tuberculosis, rheumatism, and cardiac, pulmonary, and nervous affections, none were excreted. In the fatty liver 20 per cent. to 30 per cent. of the fed amino-acids were excreted as such. Cancer of the liver behaved like the normal liver. The highest excretion of amino-acids, 50 per cent. to 70 per cent., occurred in cirrhosis, phosphorus-poisoning, and syphilis of the liver. The author explains the difference between cancer and cirrhosis by assuming that in the latter there are diffuse degenerative changes affecting the entire liver, while in cancer much of the liver tissue remains uninjured. This method requires the services of a skilled chemist.

Axisa, of Alexandria, finds that in extensive hepatic disease, such as liver-abscess, alimentary levulosuria occurs when small amounts of levulose (30 to 40 gm.) are ingested.

Urobilin may also be determined in the urine in hepatic insufficiency. It occurs in small amounts even in normal urine, but it is increased in insufficiency (urobilinuria). Its presence is most accurately determined by the spectroscope. The chemical test is as follows: Make urine strongly alkaline by means of ammonia, filter, and add a few drops of a 10 per cent. aqueous or alcoholic solution of zinc chlorid. A green fluorescence indicates the presence of urobilin.

Indican and the ethereal or aromatic sulphates are present in hepatic insufficiency, but as they are also present in excessive proteid decomposition in the intestines (page 142), they furnish no specific clue concerning hepatic inadequacy. Indican has three possible sources of origin, according to Slowtzow: (1) Decomposition of albumin in the intestine under the influence of bacteria; (2) in pus foci where large quantities of albuminous substances are undergoing rapid decomposition, as in empyema; (3) in the body-cell in cases of cachexia, hunger, etc. When of intestinal origin, it is moderate in amount and reaches its maximum amount four or five hours after meals. It is diminished by a milk-diet and by the ingestion of bismuth, while alkaline waters increase it. When of pyogenic origin, the amount is large, reaching its maximum at night and bearing no relation to meals or to the ingestion of milk, bismuth, or alkaline waters. When it finds its origin in the body-cell, the amount is uniform throughout the day, and bears no relation to the ingestion of bismuth, while milk and alkaline waters diminish it.

Porter regards the following as the most reliable test for indican: Add in a test-tube equal quantities of urine and chemically pure hydrochloric acid. To this mixture add three drops of a ½ per cent. solution of potassium permanganate. If indican is present in the urine, there will be formed a purplish cloud in the fluid in the test-tube. Then add a few drops of chloroform, then one drop more of the permanganate of potash solution, and a few more drops of the chloroform; then shake vigorously. As a result this purplish coloration will be replaced by a deep blue, which is due to precipitation of the indican by the chloroform. The amount and intensity of the precipitated indican determine the extent of the putrefactive changes going on in the alimentary tract. The author likewise regards this simple test as trustworthy.

A determination of the *glycogenic function* of the liver has been utilized in testing hepatic sufficiency. The liver converts the ingested sugar in the intestines into glycogen, and this function corresponds to the antitoxic function of the liver. In other words, if the glycogenic function is compromised, the antitoxic action is similarly involved. Achard administers 150 grams of glucose: If sugar is found in the urine, it indicates hepatic insufficiency. This temporary alimentary glycosuria (page 439) also occurs in neurotic, fatty, alcoholic, and gouty subjects, but it does not exclude hepatic inadequacy, for in the conditions cited the fundamental condition present in many instances is defective hepatic metabolism. Chiadini gives 50 grams of levulose, fasting. If the liver is intact, no glycosuria follows, but levulosuria will be observed in case of pathologic conditions in the liver. *Levulosuria* following the administration of 100 grams of levulose (Schering) in 500 grams of water on an empty stomach is an excellent index of hepatic insufficiency and liver-disease. Examination for levulose is made four hours after its ingestion; the urine (10 c.c.) is gently heated with a little resorcin and 2 c.c. of diluted hydrochloric acid, and the urine becomes reddish if levulose is present. Chauffard[186] attaches much importance to the intermittent excretion in the urine of methylene-blue when this substance is used as a test (*vide* kidney). Ordinarily this substance is eliminated continuously and not for a protracted period. In hepatic insufficiency the elimination is intermittent, it falls to the vanishing point to rise again, or it may disappear completely from the urine and reappear later. The greater the number of intermissions, the more pronounced is the functional disturbance of the hepatic cells. To execute this test the urine must be collected in different receptacles every two hours.

Liver activity can also be estimated by the presence of *urobilin* in the feces: 10 grams of the stools are rubbed in a mortar with a concentrated mercuric chlorid solution and allowed to stand from six to twenty-four hours. Urobilin will be colored red, while bilirubin converted into biliverdin imparts to the mass a green color. Both substances indicate that the liver is functionally active and that the biliary passages are open. The microscope will show the green tint of bilirubin, which may not be evident macroscopically because the color is obscured by the large amount of urobilin.

THE KIDNEY.

Physiology.—The kidney is an excretory and not a secretory organ, insomuch as the constituents of the urine are not formed in the kidney, but elsewhere, and are merely separated from the blood by the organ. The uriniferous tubules represent the glandular structure of the kidney. Each begins in the cortex of the organ as a dilatation called the capsule of Bowman (Fig. 135), which incloses a tuft of capillaries known as a Malpighian corpuscle. After the tubule leaves the capsule it becomes convoluted. The capsules and the tubules are lined by epithelial cells. Each Malpighian corpuscle is supplied with an afferent vessel from the renal artery, and the efferent vessel leaving the corpuscle has a smaller caliber than the afferent vessel, thus causing a high pressure in the tuft of capillaries. The Malpighian corpuscles represent the filtering apparatus by which certain constituents of the blood (water and salts) escape through the thin walls of the capillaries into the capsule of Bowman, which represents the commencement of each tubule. Although the process is referred to as filtration, separation of the water and salts is effected by the epithelial cells of the capsule. The latter cells also prevent the escape of the albuminous constituents of the blood. The epithelial cells of the convoluted tubules separate the other constituents of the urine (urea, urates, etc.). The nerves of the kidney are both vasoconstrictor and vasodilator in function, and true secretory nerves have not been demonstrated. An increased excretion of urine follows any rise of intracapillary pressure: (1) By augmentation of the force of the heart-beat; (2) by constriction of the arterioles in other areas; (3) by increasing the volume of fluid in the vessels, as after the ingestion of large quantities of fluid.

A diminished excretion of urine follows conditions opposed to the foregoing. Puncture of the floor of the fourth ventricle by relaxing the renal arterioles causes polyuria. The urine enters the bladder synchronously through the two ureters, but not at any regular rate. About two or three drops pass into the bladder every minute during fasting. Each drop as it enters raises the papilla at the ureteral orifice, after which the papilla closes like a sphincter.

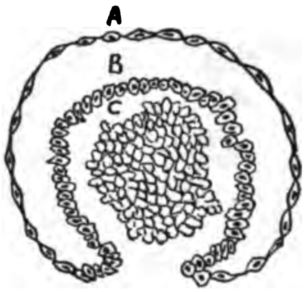


Fig. 135, I.—Transverse section of a developing Malpighian capsule and tuft (human). × 300. From a fetus at about the fourth month: *a*, flattened cells growing to form the capsule; *b*, more rounded cells; continuous with the above, reflected around *c*, and finally enveloping it; *c*, mass of embryonic cells which will later become developed into blood-vessels.

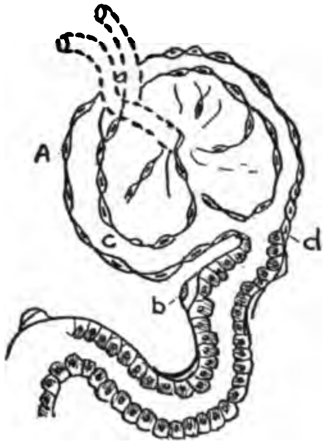


Fig. 135, II.—Epithelial elements of a Malpighian capsule and tuft, with the commencement of a urinary tubule showing the afferent and efferent vessel: *a*, layer of flat epithelium forming the capsule; *b*, similar, but rather larger epithelial cells, placed in the walls of the tube; *c*, cells, covering the vessels of the capillary tuft; *d*, commencement of the tubule, somewhat narrower than the rest of it.

The reciprocal action between the skin and kidneys is important. When the secretion of urine is augmented, the skin is dry, and, conversely, a scanty urine coexists with copious perspiration. In uremia the sweat as well as the saliva and sputum contain urea, and in some instances the skin shows a coating of urea-crystals (uridrosis). The recognition of this vicarious cutaneous function is of great value in treatment.

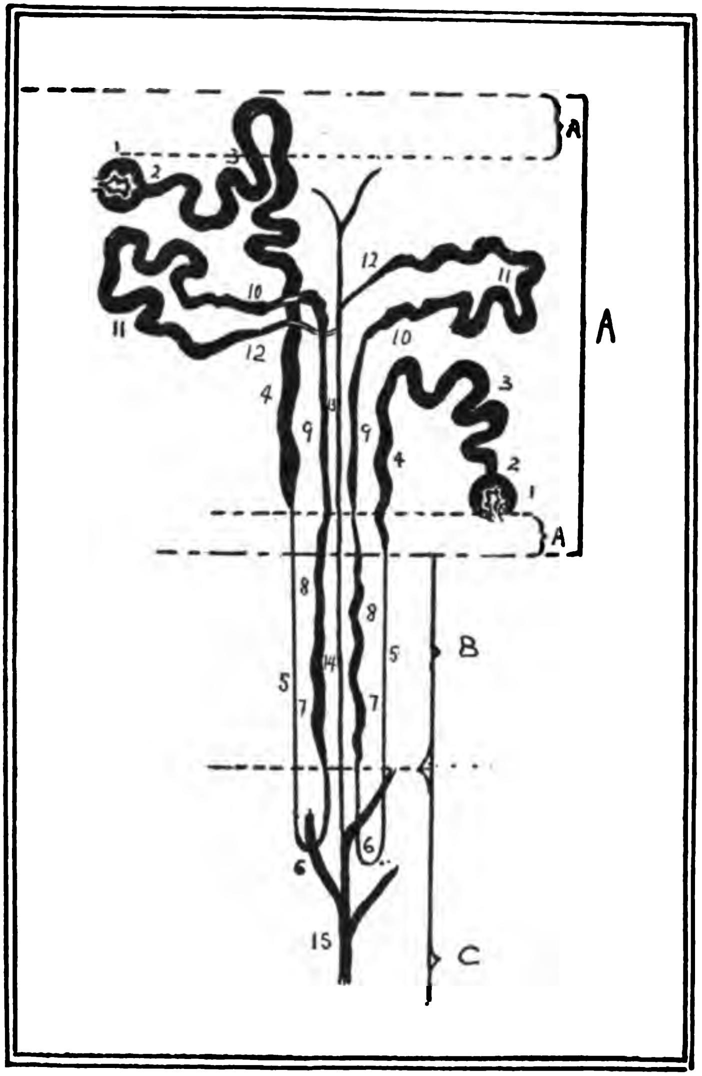


Fig. 136.—A diagram of the uriniferous tubes. *A*, cortex limited externally by the capsule; *a*, subcapsular layer not containing Malpighian corpuscles; *a'*, inner stratum of cortex, also without Malpighian capsules; *B*, boundary layer; *C*, medullary part next the boundary layer; 1, Bowman's capsule of Malpighian corpuscle; 2, neck of capsule; 3, first convoluted tubule; 4, spiral tubule; 5, descending limb of Henle's loop; 6, the loop proper; 7, thick part of the ascending limb; 8, spiral part of ascending limb; 9, narrow ascending limb in the medullary ray; 10, the zigzag tubule; 11, the second convoluted tubule; 12, the junctional tubule; 13, the collecting tubule of the medullary ray; 14, the collecting tube of the boundary layer; 15, duct of Bellini (Klein).

Pathologic Physiology.—The kidneys eliminate about 46 per cent. of our excretions. The more blood flowing through the kidneys, the greater is the amount of urine excreted. This increased flow of blood arises when the blood-pressure is augmented, as in chronic nephritis, provided there is no constriction of the renal arterioles and the function of the renal epithelium is not compromised. A local dilatation of the renal arterioles causes diuresis, even though the general blood-pressure is unaltered. An increased excretion of urine is generally accompanied by a relatively decreased excretion of solids and *vice versâ.* Diabetes insipidus is an example of diuresis following dilatation of the renal arterioles with unaltered blood-pressure.

Recent studies by Seiler show that the ingestion of large quantities of food by patients with diabetes insipidus is not succeeded, as in the norm, by an augmentation of the specific gravity of the urine. The foregoing observation has an important bearing in the treatment. Thus, restriction of fluids to such patients is only permitted as long as there is a corresponding increase in the specific gravity of the urine, showing that the solids are being excreted, for unless there is sufficient fluid to carry off the solids, the latter are concentrated in the blood.

The less blood flowing through the kidneys, the smaller will be the quantity of urine and the total excretion of urea. The factors contributory to *oliguria* (deficient secretion) may be local or constitutional. Local constriction of the renal vessels, such as occurs in the convulsions (epileptic and eclamptic), reduction of the general arterial pressure (weakness of the left ventricle), increase in the general venous pressure (weakness of the right ventricle), or a combination of the two latter conditions, will diminish the quantity of blood that flows through the kidneys and thus diminish the quantity of urine excreted.

Albuminuria.—The presence of albumin in the urine is no longer regarded as an invariable sign of organic changes in the kidney; on the contrary, albuminuria may occur with or without renal lesions. In other words, albuminuria may be differentiated as renal and false or accidental. There is reason to believe that many renal lesions which we now regard as primary are in reality secondary. Thus, it is now possible to induce albuminuria in dogs within a few hours after an intravenous injection of about 2 or 3 c.c. of a 2 per cent. solution of potassium bichromate.

Renal Albuminuria.—In this form the epithelial cells of the kidneys are in some way compromised. Normally they prevent the escape into the urine of the blood-proteids. The epithelial cells may only be compromised as far as their nutrition is concerned, thus resulting in transitory albuminuria, a condition which is observed in hemic changes (purpura, scurvy). In other instances the cells undergo degeneration in infectious diseases, and thus temporarily permit of the passage of albumin (febrile albuminuria), for during convalescence regeneration of the cells causes the evanescence of the albuminuria. When the cells are more seriously damaged, as in nephritis, the albuminuria is more persistent. In the so-called *toxic albuminurias* (page 93) many drugs excreted by the kidneys injure the epithelial cells. Thus many regard the febrile albuminurias as belonging to this class, and it is assumed that here the bacterial toxins are operative. Circulatory disturbances causing a diminished velocity of blood through the kidneys affect the nutrition of the epithelial cells and thus cause albuminuria.

Albuminuria without Renal Lesions.—All affections of the genito-urinary apparatus other than the kidneys associated with the formation of pus cause albuminuria. Many years ago I learned at Posner's clinic in Berlin of a simple method for determining whether the albumin present in the urine was wholly dependent on the pus. Naturally there is more albumin present if renal albuminuria coexists. One hundred thousand pus-corpuscles in a cubic centimeter correspond to about 1 per cent. of albumin. If the albumin exceeds this percentage, it must be referred to some origin other than the pus. The albuminimeter of Esbach may be used for the quantitative estimate of albumin. In counting the pus-corpuscles the Thoma-Zeiss counting apparatus is used after a specimen is obtained from the centrifugalized urine, which has, in turn, been obtained from the urine passed in twenty-four hours. Another method for the quantitative estimation of the amount of pus present is also original with Posner, and is valuable in determining the effect of treatment in cystitis and pyelitis. The method is as follows: The transparency of the urine (specimen taken from the mixed urine of twenty-four hours) is estimated by placing a beaker with flat bottom upon a piece of paper with ordinary sized print, and determining the height in centimeters to which it is necessary to fill the beaker, so that in good daylight the print can no longer be read. The degree of transparency is indicated by the thickness of the layer in centimeters. A transparency of ½ to 1 cm. corresponds to 40,000 pus-corpuscles per centimeter, and a transparency of 6 cm. to about 1000 pus-corpuscles. Eight centimeters thickness and above indicate normal conditions.

Leukocytes in the urinary sediment dependent on nephritis may be distinguished from the leukocytes of suppurative affections by the fact that the former are mononuclear and the latter are polymorphonuclear cells (Senator). Schnütgen employs Pappenheim's methyl-green stain for the differentiation, which consists of three parts of methyl-green and two parts of pyrolin in saturated aqueous solution. The sediment having first been washed with salt solution, is then stained in the hanging drop.

Pyuria, or pus in the urine, may be derived from the kidneys (abscesses and pyelitis), bladder, urethra, and from rupture of abscesses into the urinary passages. To exclude leukorrhea as a source of the pus, the urine should be withdrawn through a catheter. When the pus is from the kidney, the urine is usually acid, renal elements are found in the sediment, the amount of albumin is in excess of the quantity represented by the pus, and bladder symptoms are rarely pronounced. Stone and tubercle are common causes of renal pyuria. Pyuria of vesical genesis is usually associated with symptoms of cystitis, ammoniacal urine, and the absence of renal epithelium and casts and the presence of bladder epithelium. If after lavage of the bladder for several days pyuria persists, one should be rather skeptical concerning the bladder as the exclusive source of the pus. Very frequently the cystoscope is the ultimate arbitrator for determining the source and the cause of pyuria. It was at one time supposed that filtration would remove the proteid plasma, but this supposition has since been declared erroneous.

In *physiologic* or *functional albuminuria* it is impossible to say whether the renal epithelial cells are damaged; at any rate, some say they are not, and the majority say they are. In this regard the dictum of Fuller is apposite: "Reasons drawn from the urine are as brittle as the urinal." In these physiologic forms, albumin appears transitorily without symptoms in apparently healthy subjects after physical exertion, cold baths, dyspepsia, violent emotions, and after the use of food rich in albumin. In the *albuminuria of adolescence*, which is difficult to separate from the physiologic form, it may likewise appear after the aforesaid exciting factors. It is most frequent in young persons, usually weak and anemic boys of neurotic parents. When the albuminuria occurs at certain periods, it is known as *cyclic*, and when altered by position (albumin absent in the recumbent and present in the upright position), it is called *orthostatic** (page 327).

Varieties of Proteids.—In making the ordinary tests for albumin we seek to determine the presence of serum-albumin. Among the other proteids present in the urine which are of diagnostic import are: (1) globulin, (2) mucin, (3) albumoses.

Globulin rarely occurs alone, and is usually found in association with serum-albumin and has the same significance as the latter. It is said that more globulin is present with the lardaceous kidney than in other forms of nephritis. *Mucin* occurs in the urine in the dissolved and undissolved state. In the latter condition it is associated with a cloudiness (*nubecula*), and is practically what has always been called "the mucous sediment." This substance is present in all catarrhal conditions of the genito-urinary tract, and, responding to the usual tests for serum-albumin, it has often been mistaken for it. This mucin or nucleo-albumin, as it is now called, is distinguished from serum-albumin by the following tests: (1) An excess of nitric acid will dissolve nucleo-albumin after shaking the tube; (2) it is precipitated by acetic acid.

Albumosuria should include propeptonuria and peptonuria. Albumoses in the urine are only of diagnostic import in the absence of serum-albumin. When albumosuria is pronounced, it indicates deep-seated suppuration and *myelopathic albumosuria.* The latter is a fatal disease characterized by multiple myelomata of the bones. Comparatively few cases are on record. The disease usually occurs in adult males, although the only two cases I ever saw were in women. The test for Bence-Jones albumose occurring in this disease is the white precipitate following the addition of nitric acid to the urine, the disappearance of this precipitate on boiling, and its reappearance when the urine is cooled.

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* In *orthostatic albuminuria* (page 327) the albumin in the urine may often be made to disappear, if the muscles of the back are strengthened or supported by a corset or if the sole of the shoe is made thicker.

Casts.—Urinary casts are microscopic cylindric formations which originate in the uriniferous tubules. Casts are usually associated with all forms of renal albuminuria, but they may be present in the urine independent of albuminuria, as in certain forms of nephritis (contracted kidney) and icterus. Casts are differentiated according to their composition into epithelial, waxy, hyaline casts composed of either red or white blood-corpuscles (blood-casts), casts composed of bacteria, and uric-acid casts in the new-born. Casts of all kinds may become covered either with bacteria or urates derived from the urine and quite independent of renal origin. Formerly it was customary to make inferences concerning the diagnostic value of the different varieties of casts, but such conclusions are erroneous. There are a number of false casts, notably mucous and testicular casts.

Conclusions Concerning Albuminuria.—1. Albuminuria is no more an expression of renal disease than is a murmur an expression of a cardiac disease. Just as we test the competency of the heart-muscle and disregard murmurs in a prognostic direction, so must we disregard albumin and content ourselves with determining whether the kidneys functionate adequately as filters.

2. In chronic interstitial nephritis only traces of albumin are found, and in numerous instances it is absent notably in the morning urine.

3. If traces of albumin and a few casts are found in individuals beyond the age of fifty years, they should not be regarded as an evidence of nephritis; in fact, they increase with advancing age and merely express a senile degeneration.

4. In the so-called physiologic albuminurias, albuminuria occurs after certain exciting causes: cold baths, exertion, the ingestion of raw eggs, etc., but we must also remember that like factors will augment the output of albumin in renal disease, but in the former instance the appearance of albumin is intermittent and in the latter continuous.

5. Persistent high blood-pressure and cardiac signs (hypertrophy of the left ventricle and accentuated second aortic sound) are valuable aids in the diagnosis of a renal albuminuria.

6. The presence of casts and albuminuria is an argument in favor of renal disease, and centrifugation of the urine is an indispensable maneuver for the detection of tube-casts in the sediment.

7. In women, owing to vaginal contamination, traces of albumin are invariably found, hence the importance of directing the patient to take a vaginal injection before micturition.

8. Many so-called cases of Bright's disease are really instances of toxic nephritis dependent on digestive anomalies or auto-intoxication. In such cases one is always justified in trying purgation to note its influence on the albuminuria.

Hematuria.—Blood, like pus, may be derived from any part of the urinary tract. Blood from the bladder is characterized by the following signs: it may be in clots or by itself, the symptoms are essentially vesical, and bladder epithelium is found in the sediment of the urine. If from the kidney, the presence of blood is less obvious, and there is a smokiness of the urine. If clots are present, they have the shape of the ureter. Bladder symptoms are usually absent, and any associate signs are essentially renal, such as blood-casts of renal tubules and local pain in the renal region or in the groin and testes. Sir Henry Thompson suggested the following method for ascertaining whether the blood came from the kidney or bladder, a method which, by the way, may be utilized in determining the renal or vesical origin of pus: Introduce a soft catheter just within the neck of the bladder, and after drawing off the urine, wash out the cavity gently with tepid water. If the water cannot be made to flow away clear, it is very likely that the blood is derived from the bladder. If the water can be made to flow away clear, the catheter is corked for a few moments (the patient resting) and the first quantity of urine which collects is withdrawn. If the latter is bloody, and after lavage again of the bladder the urine comes away clear, it is evident that the blood is of renal origin.

Blood from the neck of the bladder can be demonstrated by squeezing the prostate and neck of the bladder when the last drops of urine are voided. When a calculus is the cause of vesical hematuria, exercise aggravates and rest modifies the bleeding. Blood is usually passed with the last few drops of urine. One of the primary symptoms of a tumor of the bladder is hematuria, and it is stated by Casper that a tumor that bleeds is nearly always malignant. In tuberculosis hematuria is usually associated with tenesmus and pyuria. It is generally conceded that when a cystitis cannot be traced to gonorrhea or infection from without, it is suspicious of tuberculosis. Hematuria of renal origin is usually caused by tuberculosis, acute nephritis, hemophilia, stone, and tumors.

The Circulation in Renal Disease.—In practically all forms of nephritis the arterial pressure is raised, and, according to v. Bamberger, the left ventricle of the heart enlarges in about half the cases, and in a small number of instances both ventricles are implicated. Clinically, an accentuation of the second pulmonic sound indicates either increased pressure (in the pulmonary circulation) or a hypertrophy of the right ventricle, whereas an accentuation of the second aortic sound expresses either condition of the left heart. In certain nephritides occurring in the course of infectious diseases and after poisoning by phosphorus and arsenic, cardiac hypertrophy is not usually present. No adequate theory is at our command to explain the increased arterial pressure and cardiac hypertrophy in renal disease.

Uremia.—This is a toxemia occurring in nephritis and in anuria. One theory of uremia supposes the accumulation in the blood of toxic substances which are not excreted by the kidneys, but the nature of the toxic material is undetermined. Another theory supposes that the kidney has an internal secretion, any disturbance of which causes uremia. It is of great importance to recognize latent forms of uremia (page 316).

TESTS FOR RENAL SUFFICIENCY.

Cryoscopy.—This method is based on the fact that the freezing-point of a solution varies according to the amount and nature of the substance contained in it in solution; in other words, a watery solution containing little solid material will freeze at a higher temperature than one containing more solid material. Thus, in renal disease when the solids are only partially eliminated, the urine freezes at a higher temperature than normal, and that the blood of the same individual, owing to the retention of solids, would freeze at a lower temperature than normal. The difference between the freezing-point of distilled water and that of the fluid examined is represented by the symbol △ (delta). The △ for normal urine varies from —0.8° to 0.2° C., and less than —0.8° C. indicates disease. Korànyi places the freezing-point of urine (△U) between —1.30° and —2.30° C. The freezing-point of the blood is practically constant at —0.56° C.

Test.—There are several cryoscopes on the market, notably that of Fontaine (Fig. 137) and the Beckmann-Heidenhain apparatus, and as directions accompany them, we may disregard the latter other than to say that the apparatus consists essentially of a thermometer (Centigrade), test-tubes, and a freezing mixture of ice and salt. Ten c.c. of the blood or urine are necessary for the examination, and both are collected simultaneously: the blood by aspirating a superficial vein, and the urine by catheterizing each ureter if the test seeks to determine the functional activity of each kidney.

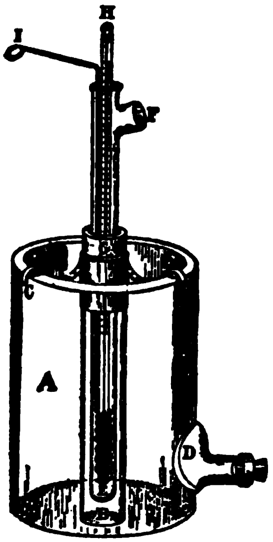

Fig. 137.—Fontaine's cryoscope. *A* is the glass freezing-jar provided with a large test-tube (*B*) passing to its center and fixed by a metal support (*C*); *D* is a drain for the liquid which accumulates as the ice-salt mixture melts; *G* is a small test-tube having a lateral vent (*F*); *H* is a thermometer encircled by a metal spiral stirrer (*I*)

Conclusions: The freezing-point of the urine shows so many variations, even in the normal subject, that all deductions by this method are necessarily faulty. The freezing-point of the blood is practically constant, and, according to Korànyi, when one kidney is inefficient, no change in the freezing-point is noted, and it is only when the function of both kidneys is involved that the freezing-point of the blood is diminished. According to Walker,[178] a point △ of —0.59° should be shown before bilateral disease is diagnosed. Comparative cryoscopy of the urine and blood is relatively more accurate than the examination of either fluid alone. Korànyi observes that when it is a question in diagnosis between typhoid fever and pneumonia, a △ of the blood above —0.56° C. indicates pneumonia, and if after the free inhalation of oxygen the normal $\triangle$(—0.56° C.) is not re-established, a renal lesion is probably present.

Methylene-blue.—Many drugs are eliminated with difficulty in renal disease, and the untoward effects of the iodids, salicylates, mercury, and other drugs have directed attention to the kidneys. The methylene-blue test, according to Walker, is more accurately executed by an intramuscular injection of a 5 per cent. solution of methylene-blue and the dose is 15 minims. It is absorbed into the blood from the point of injection as a colorless derivative known as chromogen, and it is transformed by the liver and kidneys into methylene-blue. It is excreted in the bile and urine. In the urine it is eliminated as methylene-blue and partly as a colorless derivative (chromogen). The latter is transformed into methylene-blue by boiling with acetic acid. Chromogen commences to appear in the urine fifteen minutes after the injection and the blue in about thirty minutes. The duration of elimination is from thirty-five to sixty hours. The elimination of blue reaches its maximum about four hours after the injection and remains at this level for about four and one-half hours, and after about thirty-five hours it assumes a pale green tint.

Conclusions: In renal disease the elimination of blue is delayed and may not appear for several hours or not at all. This period of delay increases with the severity of the lesion. Usually the elimination of chromogen is equally delayed, but in some instances the commencement of elimination of chromogen may be normal, whereas the blue is delayed. The time of elimination is shortened in parenchymatous nephritis (Bard), and is usually associated with a reduction in the quantity of blue eliminated. A prolonged elimination is observed when there is extensive renal lesions: thus, in chronic interstitial nephritis the blue may be present in the urine for ten or more days. Intermittent elimination of blue is noted in functional hepatic affections (page 827). In this and other methods of determining renal sufficiency there is always an element of error which cannot be avoided. Bradford has shown that in animals two-thirds of the total renal tissue may be removed and yet the animal may continue in good health. If, however, the tissue removed is reduced to one-quarter, death occurs.

Phloridzin.—In 1885 Mering demonstrated that an injection of phloridzin induced temporary glycosuria lasting a few hours. The amount of sugar excreted did not depend upon the dose of the drug, provided it was given in sufficient quantity to produce the maximal effect. This form of glycosuria is of renal origin and is supposed to be caused by some change in the renal cells whereby they become permeable for the sugar normally present in the blood. Later, Achard and others employed this drug as a test of the renal function, and it was shown that sugar elimination was dependent upon the functional activity of the kidneys. Walker uses 15 minims of phloridzin solution (1 : 200) by subcutaneous injection. In a healthy subject sugar appears in the urine in from fifteen to thirty minutes and the glycosuria continues for from two to four hours. The most important factor in the test, according to Walker, is the total quantity of sugar eliminated, which varies from 1 to 2 grams. A diminished phloridzin-glycosuria usually indicates a renal disease, and a complete absence of sugar may be regarded as a sign of advanced renal disease. Among the other tests may be mentioned:

1. Estimation of the ***nitrogenous excretion***. This test is faulty because there is no fixed quantity of urea or nitrogen excreted. A certain amount of the nitrogen of the body is excreted in the feces, hence, without taking the latter into consideration, it is impossible to estimate the total nitrogen removed from the body. The fluctuations of nitrogenous excretion in nephritis may be no more than occur in healthy persons.

The average total amount of urea passed in twenty-four hours is from 350 to 400 grains in a healthy person in bed on a farinaceous diet. If under such conditions less than 300 grains are excreted, renal insufficiency may exist. The following table shows the minimum amounts of total urinary solids which can be regarded as normal with reference to the weight of the individual (Etheridge):

WEIGHT.	MINIMUM URINARY SOLIDS.
90 pounds	500 grains
100 "	570 "
110 "	640 "
120 "	710 "
130 "	780 "
140 "	850 "
150 "	920 "
160 "	990 "
170 "	1060 "
180 "	1100 "

2. The *electrical resistance* of the urine is based on the fact that the conductivity of the urine is dependent on the mineral and not on its organic constituents, and according to this resistance, conclusions are formulated. This test thus far has not been shown to be of practical value.

3. Determination of the *toxicity* of the urine is based on the principle that the kidneys remove metabolic poisons from the blood and that the normal urine is poisonous. The lethal dose (by injection) of normal urine for rabbits varies from 40 to 50 grams per kilogram of body-weight. If the kidneys fail to eliminate the poisons, then a larger injection of urine would be necessary to produce death of the animal. This test may yield valuable information when the toxicity of the urine and blood is established synchronously.

4. The *indigo-carmin test* is regarded by many as a trustworthy indication of the functional capacity of the kidneys; it should appear in the urine in ten or twelve minutes, and the more protracted the delay in its appearance, the greater is the functional renal insufficiency. The test is executed by the injection into the muscles of 20 c.c. of a 0.4 per cent. solution of the dye, which represents 0.08 gram.

5. The *concentration test* of Cabot for renal sufficiency is to ascertain the ability of the kidneys to secrete a dilute urine after copious intake of water, and a concentrated urine when water is restricted.

6. *Potassium Iodid Test.*—The patient takes two tablets (each containing 25 centigrams) of potassium iodid. The entire quantity of urine excreted in twenty-four hours is collected and measured. In a quantity of water equal in amount to that of the urine, a tablet of potassium iodid (25 centigrams) is dissolved, and from this solution, as well as the urine, the iodid is set free by the addition of fuming nitric acid. Next, equal quantities of the urine and the aqueous solution are mixed with 10 to 20 c.c. of benzin. Both solutions are compared colorimetrically, and an addition, if necessary, is added to the aqueous solution until both solutions are alike in color (Olrum).

Observations demonstrated that in granular atrophy of the kidney, the excretion of the drug is delayed (as long as 187 hours), whereas in parenchymatous nephritis there is no delay in the excretion. Arteriosclerosis without granular atrophy is without any influence on the excretion. It is especially in the differentiation of interstitial and parenchymatous nephritis that this test is of value.

7. *Salicylic Acid Test.*—One c.c. of a 30 per cent. solution of sodium salicylate is injected intramuscularly with a little cocain to prevent pain. In the norm, the violet color (with a 10 per cent. Fe_2Cl_6) is detected in the voided urine at the end of half an hour, reaches its maximum in from one to three hours, and disappears in from eight to twelve hours.

8. *Chlorid Excretion.*—The test of alimentary chloruria consists in placing the patient on a milk diet (3 liters per day), and, after the third day, adding sodium chlorid, 10 grams a day, dissolved in 125 c.c. of water, which are given in three portions on each of four consecutive days. The daily output of the chlorids is estimated. In the norm, the excretion commences at once and ends abruptly when ingestion ceases. Clinical results show that this method is unreliable as an index in renal disease.

9. *Potassium Permanganate Test.*—This is a simple method which I employ, based on the fact that organic material will decolorize this chemical. Fill an Esbach's albuminimeter up to U with water, to which is added one drop of a saturated solution of potassium permanganate. Then, with a medicine dropper, urine is added drop by drop (shaking mixture each time), until the solution is decolorized. In the norm, about 28 drops of urine will decolorize the solution. If the physician has no albuminimeter, a definite amount of water may be colored with one drop of permanganate solution, and after noting the number of drops of normal urine necessary to decolorize the solution, the urine to be tested is examined and conclusions formulated.

10. *Albarran's Test.*—This test is practically an "experimental polyuria," and consists in giving the patient from 400 to 600 grams of a diuretic mineral water, such as Evian, and collecting the urine every half-hour. The amount of urine, its molecular concentration, and the amount of urea and chlorids are determined in percentages. In normal kidneys the molecular concentration and the percentage of urea and chlorids diminish in the same

proportion as the amount of urine increases, and in diseased kidneys the amounts of urea and chlorids diminish in disproportion to the increase in the amount of fluid excreted.

Estimation of the Function of One Kidney.—In the tests already cited, only the combined function of the kidneys can be established, but here the endeavor is to obtain the urine of each kidney separately. For this purpose either ureteral catheterization by means of the cystoscope (page 433) is executed or the less difficult urinary separator (page 435) is used. According to Albarran,[188] if the secretion of each kidney is collected for from six to twelve hours, it will be demonstrated that each kidney performs practically the same amount of work. According to Walker,[187] who has thoroughly investigated this subject, a healthy kidney secretes a urine like the following in twenty-four hours:

Quantity	600 to 700 c.c.
Urea	12 to 15 grams.
Chlorids	5 to 6 grams.
Δ	—1.30° to —1.50° C.

If the urine is only collected during a period of several hours, the figures are less exact. In the latter event the urine should not be collected during digestion, and the individual should not have ingested fluid for several hours. Under the latter conditions the urine collected from one kidney during one hour when both kidneys are healthy shows the following:

Quantity	50 to 60 c.c.
Δ	—1.20° to —1.50° C.
Urea	12 to 17 grams per liter.
NaCl	10 to 12 " " "

In cryoscopy of the two urines Walker concludes: "When the volume of one kidney is greater and the freezing-point shows at the same time a greater molecular content, this kidney is functionally more active than its neighbor. In the lesser degrees of renal disease the cryoscopy figures are not usually altered, but where the disease has destroyed a large part of a kidney, there is usually a marked difference between the freezing-points of the two urines." In making the comparative methylene-blue test, separation of the two urines for one or two hours will suffice. Here it is important to recognize the time of appearance of the blue and chromogen and the depth of staining. When the elimination occurs early and the depth of staining is good, the kidney may be regarded as functionally active. In the comparative phloridzin test the elimination of glucose is equal in both kidneys, *i. e.*, it commences at the same time (fifteen to twenty minutes after the injection) and the elimination continues for the same period (usually within two hours). When one kidney is diseased, there may be no elimination of sugar on that side. If sugar is eliminated by a diseased kidney, the commencement of the glycosuria may be delayed beyond thirty minutes.

Beer has recently discredited the functional renal tests by observing that a kidney may be so influenced in its excretory activity, owing to the presence of a diseased kidney, as to exhibit functional deficiency, and that when this influence is eliminated, the apparently inadequate second kidney responds to the functional tests as a normal organ.

MAMMARY GLAND.

From 500 to 1500 c.c. of milk are secreted daily. Sucking increases the secretion. Frequent and rapid emptying of the gland increases the flow, and the milk becomes richer in casein. Human milk is alkaline in reaction. Many drugs ingested by the mother are secreted in the milk. The natural food for the infant is the mother's milk and no perfect substitute exists. In determining the sufficiency of the mammary gland many factors must be taken into consideration. If the child shows no dyspeptic symptoms and gains about ½ ounce in weight a day, the sufficiency of the gland need not be questioned. The gland may be sufficient and yet breast-fed children may suffer in consequence of over-feeding. The average stomach capacity of a healthy infant, is about as follows (Caillé):

At birth	1 ounce.
Two months	3 ounces.
Six months	6 ounces.
Twelve to fourteen months	9 ounces.

The composition of the milk is influenced by the age of the mother, diet, exercise, acute and chronic diseases, etc. Very concentrated milk may be nutritious, but owing to its difficult digestion may cause dyspeptic symptoms. Milk testers are sold for determining the composition of milk, but when an accurate analysis is desirable, the milk should be sent to an experimental station. If the milk has been found to be overrich, a plain diet and exercise for the mother are indicated. The nutritious elements of the milk may be increased by limiting the amount of exercise and inducing the mother to ingest a liberal diet of eggs and meat. Beer and porter may increase the quantity but do not modify the quality of the milk.

THE PANCREAS.

Physiology.—The most important ferments (enzymes) of this gland are: (1) *Trypsin,* which possesses an action like pepsin, by which proteids are peptonized. The action of trypsin is, however, more rapid than that of pepsin and it acts in alkaline, whereas pepsin acts in an acid, medium. (2) *Amylopsin,* which converts starch into maltose and in this action is more powerful than saliva. The absence of amylopsin in the pancreatic juice of infants suggests that starch is not indicated in the diet of the latter. (3) *Steapsin* forms an emulsion and decomposes the fats. (4) *Milk-curdling ferment,* which causes clotting of milk, an action which is comparatively insignificant considering the fact that the milk has already been curdled by the rennin of the stomach. The acid of the gastric juice as it passes into the duodenum is the natural stimulus for the pancreatic flow. Starling and Bayliss have shown that the exciting substance is not acid, but a substance produced in the duodenal intestinal mucosa under the influence of the acid, called *secretin,* and it is the latter which produces the pancreatic flow. If we study the histology of the pancreas, one fact is of special interest to the clinician, viz., the presence of groups of polygonal cells (Fig. 138), which differ in appearance from the surrounding glandular tissue. They are called, after the discoverer, islands of Langerhans, and they are supposed to have no connection with the pancreatic ducts.

Pathologic Physiology.—Extirpation of the pancreas in animals is followed by glycosuria. If a small portion of the gland remains, or by grafting the pancreas from another animal into the abdomen of the animal from which the pancreas has been removed, there is no ensuing glycosuria. According to

Hansemann, lesions of the pancreas are found in 50 per cent. of the cases of diabetes, and diabetes is frequently secondary to pancreatic lesions (atrophy, fat-necroses, calculi, chronic interstitial inflammation). Pancreatic diabetes (page 118) may result from arteriosclerosis of the pancreatic vessels. The pancreas has an external secretion which is discharged into the intestines, and an internal secretion which contains a glycolytic body which causes combustion of the glucose. It is supposed that the glycolytic body is formed by the cells making up the islands of Langerhans; in fact, lesions of these cells are not infrequently found in diabetes. Bramwell and Thompson[189] have described cases of *pancreatic infantilism* (page 313) in which delayed growth was accompanied by diarrhea and fatty stools. After treatment with pancreatic preparations Bramwell's case showed a decided improvement, although the treatment was continued for nearly two and one-half years. *Pancreatic hemorrhage* into the substance of the gland may cause sudden death. The patient may have been apparently well, but is suddenly attacked with pains in the upper abdomen, persistent vomiting, restlessness, and

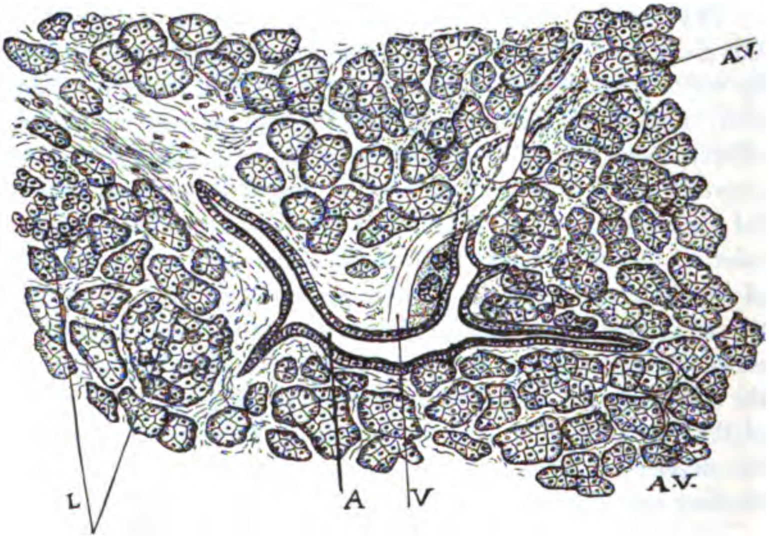

Fig. 138.—Section of the human pancreas: *L*, Islands of Langerhans; *A*, pancreatic duct and branches; *A.V.*, acini of pancreas; *V*, vein.

collapse symptoms. In these cases it is advised to open the abdomen and relieve the tension of the pancreas, insomuch as death is due to pressure and rarely to the loss of blood. In one patient, a woman, whom I saw in consultation, this was done, but without any result. There are three forms of *acute pancreatitis* (hemorrhagic, suppurative, and gangrenous). The etiology is obscure, and the majority of cases are in adult males. The condition is supposed in some cases to be related to gall-stones. In the case of Opie, the calculus was so located that it obstructed the pancreatic and common bile-duct, and the bile finding its way into the pancreas caused hemorrhagic inflammation. The lesion was reproduced by the injection of bile into the pancreatic ducts of dogs. In pancreatitis the symptoms commence suddenly with colicky pains in the upper abdomen, vomiting, tenderness in the region of the pancreas, and collapse.

In pancreatic disease areas of *fat-necrosis* have not only been found in the pancreas, but in the mesentery, omentum, subcutaneous fat, and elsewhere. When they occur in the abdominal fat, the yellowish areas may not exceed a pin's head in size, and they may be mistaken for minute growths or tubercles. In some instances they have reached the size of a hen's egg. On section, they have a soft, tallowy consistence, and, according to Langerhans, they consist of lime and fatty acids. Like lesions have been produced in the subcutaneous fat by inserting pieces of sterile pancreas under the skin.

Chronic pancreatitis is characterized histologically by inflammation of the interstitial tissue, leading either to hypertrophy or to atrophy of the gland. The head of the organ may be enlarged and indurated and thus cause occlusion of the common bile-duct.

Pancreatic cysts may occur as the result of traumatism from blows or constant pressure in the upper abdomen, or from inflammatory conditions, or independent of any recognizable cause. In one case the cause given was severe massage. Puncture of the cyst is important in diagnosis (page 606).

Tumors of the pancreas are usually carcinomatous and the head of the gland is usually involved. The chief diagnostic features are persistent and intense icterus (pressure on the bile-duct), rapid emaciation, epigastric tumor, and symptoms associated with functional disturbances of the gland.

Pancreatic calculi are not frequent. They are associated with colicky attacks and the pain is located in the epigastrium or left hypochondrium. Usually jaundice is absent. Pronounced salivation and symptoms associated with disturbed function of the gland (fatty-stools, glycosuria) are frequent. The calculus may provoke a chronic interstitial pancreatitis and thus cause diabetes. Pancreatic stones if found in the feces, or if they perforate externally through an abscess, are very hard and contain a large quantity of organic matter.

TESTS FOR SUFFICIENCY OF THE PANCREAS.

In lesions of the pancreas the use of pancreatic preparations may aid in diagnosis (page 313). The latter is especially true of pancreatic dyspepsia. The iodoform test of Sahli (page 197) and the salol test (page 267) have already been described.

Fecal Examination.—The pancreatic juice is a predominant factor in the digestion of fats, and in diseases of the pancreas or when its duct is occluded "fat-stools" are frequently observed. This fatty diarrhea is easily recognized. It is important to observe in this connection that an abnormal amount of fat may be present in the stools in icterus, and that even in extensive pancreatic disease fat-stools may be absent, for the reason that undigested emulsified fat may be absorbed, and, further, that digestion may be effected by the vicarious action of the bile. Salomon finds in diseases of the pancreas that when an oatmeal-gruel diet is given, the stools show the presence of undigested fat. These "butter-stools" are found on the second day of the oatmeal diet. Müller's test for determining the functions of the pancreas is based on the proteolytic action of the pancreatic ferment trypsin. After the patient is given a test meal, two hours later he receives a calomel purge. A few drops of the thin stool thus obtained are sown on a plate of Löffler serum. It is kept for twenty-four hours at a temperature of 130° to 140° F. If any pancreatic ferment is present in the stool, the surface of the serum shows decided depressions where the ferment has been at work. If the ferment is absent, the surface of the serum remains smooth. In practically all forms of pancreatic disease rapid emaciation is a prominent symptom, for the reason that the elements of the food are not fully utilized and are excreted undigested with the feces. When there is no diarrhea and the stools contain undigested muscle-fiber, there is probably a deficient secretion of pancreatic juice. For further facts concerning examination of the stool in pancreatic insufficiency, *vide* tests for intestinal insufficiency.

The Urine.—Pancreatic juice converts albuminous substances into peptone, and from this in turn, by putrefactive fermentation, indol is produced, and the latter is excreted in the urine as indican. Some contend that if indican can be detected in the urine even by a feeble reaction (page 476), it indicates that it is excreted in excessive quantity. Most of the indol is produced from the pancreas-peptone, and the formation of the latter being partially or completely inhibited in affections of the pancreas, the presence of indican in the urine contraindicates disease of the gland. Glycosuria may or may not be present, for physiologic experiments show that no sugar is present in the urine if the pancreatic ducts are constricted and if more than one-twelfth of the organ is allowed to remain in the body.

The Cammidge reaction as a test for pancreatic disease is as follows:[346] A specimen of the twenty-four-hours' urine, or of the mixed morning and evening secretions, is filtered several times through the same filter-paper and examined for albumin, sugar, bile, urobilin, and indican. A quantitative estimation of the chlorids, phosphates, and urea is also made, and the centrifugalized deposit from the urine examined microscopically for calcium oxalate crystals. If the urine is found to be free from sugar and albumin, and of an acid reaction, 1 c.c. of strong hydrochloric acid (specific gravity 1.16) is mixed with 20 c.c. of the clear filtrate, and the mixture gently boiled on the sand-bath in a small flask, having a long-stemmed funnel in the neck to act as a condenser. After ten minutes' boiling the flask is well cooled in a stream of water, and the contents made up to 20 c.c. with cold distilled water. The excess of acid present is neutralized by slowly adding 4 grams of lead carbonate. After standing for a few minutes the flask is again cooled in running water and the contents filtered through a well-moistened, close-grained filter-paper until a perfectly clear filtrate is secured. The filtrate is then well shaken with 4 grams of powdered tribasic lead acetate and the resulting precipitate removed by filtration, an absolutely clear filtrate being obtained by repeating the filtration several times if necessary. The large amount of lead in solution is removed either by treatment with a stream of sulphuretted hydrogen or by precipitating the lead as a sulphate. For this purpose the clear filtrate is well shaken with 2 grams of finely powdered sodium sulphate, the mixture heated to the boiling-point, then cooled to as low a temperature as possible in a stream of cold water, and the white precipitate removed by careful filtration; 10 c.c. of the perfectly clear transparent filtrate is made up to 18 c.c. with distilled water and added to 0.8 gram of phenylhydrazin hydrochlorate, 2 grams of powdered sodium acetate, and 1 c.c. of 50 per cent. acetic acid contained in a small flask fitted with a funnel condenser. The mixture is boiled on a sand-bath for ten minutes, and then filtered hot through a filter-paper moistened with hot water into a test-tube provided with a 15 c.c. mark. Should the filtrate fail to reach the mark, it is made up to 15 c.c. with hot distilled water. In well-marked cases of pancreatic inflammation a light yellow, flocculent precipitate should form in a few hours, but it may be necessary to leave the preparation to stand overnight before a deposit occurs. Under the microscope the precipitate is seen to consist of long, light yellow, flexible, hair-like crystals, arranged in sheaves which, when irrigated with 33 per cent. sulphuric acid, melt away and disappear in from ten to fifteen seconds after the acid first touches them. The urine employed for the experiment should be fresh, and not have undergone fermentative changes. If alkaline in reaction, it should be made acid with hydrochloric acid before the test is commenced; any glucose that may be present should be removed by fermentation after the urine has been boiled with the acid, and the excess neutralized.

Pancreatic Diabetes.—Injections of adrenalin will produce glycosuria, and Zuelzer has found that the injection of pancreatic extract at the same time with injection of adrenalin in animals was not followed by glycosuria. According to this observation, diabetes mellitus is caused by an exaggerated internal secretion of the suprarenal glands, which is counteracted in the organism by the diastase secreted by the pancreas. Hence, pancreatic insufficiency may cause diabetes. The theory is not wholly tenable, for two reasons: in diabetes the physiologic phenomena of adrenalin (high tension, bradycardia) are not always present, and glycosuria is not always present in certain degenerative diseases of the pancreas.

THE STOMACH.

Physiology.—The wall of the stomach consists of the following coats: (1) peritoneal, (2) muscular, (3) submucous, (4) mucous. In the submucous and muscular coats are plexuses derived from the pneumogastric and sympathetic, which are the nerves of this organ. The gastric juice secreted by the glands in the mucosa of the organ contains two ferments—pepsin, which converts the proteids of the food into diffusible peptones, and a lab-ferment, which coagulates casein. Fats are not chemically altered in the stomach, but their proteid envelopes are dissolved. The third constituent of the gastric juice is hydrochloric acid (0.4 to 0.6 per cent.), which is probably formed from the chlorids of the blood and lymph.

Physiology of Digestion.—1. The first period of digestion in the stomach is the amylolytic, and consists in the conversion of starch into dextrin (achroö-dextrin and erythro-dextrin). The digestion is effected in the stomach by the swallowed saliva.

2. Grape-sugar, which is a final product of starch-digestion, is converted into lactic acid by the action of micro-organisms that excite fermentation.

3. The amylolytic period of digestion lasts, on an average, three-quarters of an hour.

4. Hydrochloric acid and pepsin are secreted immediately after the ingestion of food.

5. When hydrochloric acid is first secreted, it is in combination, and the free acid is not present until three-quarters of an hour after the ingestion of food. The acid combines with the proteids and the mineral salts of the food to form acid proteids (syntonin) and acid salts, after which free acid is found.

6. Free hydrochloric acid inhibits amylolytic digestion, as the digestion of starch does not proceed in an acid medium.

7. Lactic acid disappears from the stomach one hour after the ingestion of food, or at a time when free hydrochloric acid is present.

8. Simultaneously with the free hydrochloric acid the milk-curdling ferment (rennet ferment), which coagulates the casein of milk, and the ferment pepsin are secreted.

9. Pepsin and the rennet ferment are not secreted as such, but are formed by their ferments, propepsin and rennet zymogen, into pepsin and rennet ferment, respectively, by the influence of hydrochloric acid.

10. The second or hydrochloric acid period of digestion consists in a peptonizing action of the gastric juice upon the albuminous bodies.

11. Free hydrochloric acid is antiseptic, destroying all micro-organisms concerned in fermentation and putrefaction.

12. During digestion some of the digested food is absorbed, while the remaining portion (chyme) slowly passes into the duodenum.

13. About six hours after a mixed meal the stomach should be practically empty.

14. In the intervals of digestion the stomach contains only a small amount of clear fluid of neutral reaction.

15. The experiments of Pawlow show that mechanic excitation of the stomach-wall produces no secretion and that the chief excitant of the gastric flow is psychic. The larger the proportion of proteid in the diet, the greater is the quantity of juice and the more pepsin and acid will it contain.

16. Aside from the chemic factors, the rotary and peristaltic movements of the stomach play an important rôle in digestion. The former movements succeed in mixing the ingesta with the gastric fluid, whereas the peristaltic movements force the contents of the stomach interruptedly into the duodenum.

Pathologic Physiology.—The neuroses of the stomach are motor and sensory disturbances and are described under the generic term *nervous dyspepsia.* The disturbances are usually functional, without anatomic basis, and occur in neurasthenic subjects; in fact, the gastric manifestations dominate the neurasthenic syndrome. The diagnosis of nervous dyspepsia has already been discussed (page 131). The *motor neuroses* are the following:

1. *Hyperkinesis*, which signifies excessive motor activity of

the organ, in consequence of which food is prematurely discharged into the duodenum.

2. *Peristaltic unrest* signifies an abnormal increase of the peristaltic movements of the organ, which may be communicated to the intestines, and the patient suffers immediately after eating from borborygmi and gurgling, which may be heard by others.

3. *Nervous eructations* (*aërophagia*). I have reported[199] several cases of nervous eructation studied skiascopically, and found that the stomach is not usually implicated in the genesis of the eructations because no movements of the organ are observed during the time of the eructations, and that the latter cease when the stomach-tube is introduced into the esophagus. In other words, the gas is usually brought up from the esophagus.

4. *Nervous vomiting* usually attacks hysterical subjects and there is no nausea nor gagging, and nutrition being unaffected, the hysterical character of the symptom is revealed. Occurring in children, it is often referred to acid intoxication, because acetone is found in the urine, and the attacks are benefited by large doses of bicarbonate of soda.

5. *Rumination* (*merycismus*) refers to the regurgitation from the stomach of food which is chewed again.

6. *Cardiac spasm* is a condition produced by contraction of the muscular fibers at the cardiac orifice when a morsel of food passes the cardia. If this condition is associated with spasm of the pylorus, and air has been swallowed (aërophagy), it cannot escape in either direction, and inflation of the stomach (pneumatosis) occurs, causing precordial anxiety and dyspeptic asthma. Cardiac spasm may be of organic origin (ulcer and carcinoma of the cardia). The following facts, according to Leube, would indicate that the spasm is an independent motor neurosis: A thick tube passes the narrow area without obstruction, whereas a thin tube may be arrested at other times. Cocainization of the region of the cardia permits of sounding and swallowing of food, and very often the use of belladonna and morphin before meals overcomes the difficult deglutition.

7. *Pyloric spasm.* This may be caused by superacidity or a gastric ulcer. In the former instance bicarbonate of soda may relieve the spasm. The condition may often be diagnosed by

the delayed appearance of salicylic acid in the urine after the salol test (page 267) or by iodin in the saliva (page 193).

8. *Atony* of the stomach is motor insufficiency of the organ leading to dilatation. The subjects are usually distressed by a feeling of weight, pressure, eructations, etc.

9. *Incontinence of the pylorus* is of less clinical value than the same condition of the cardia. The diagnosis of the former has already been discussed.

10. *Insufficiency of the cardia* is supposed by some to be the fundamental condition in nervous eructations and rumination. The regurgitation in the latter condition may be simulated by an esophageal diverticulum, but the material in the latter condition is not acid in reaction.

The *sensory neuroses* are as follows:

1. *Hyperesthesia,* in which the patient complains of all kinds of distressing gastric sensations after eating, even though the stomach is empty and an analysis of the gastric contents shows no anomaly in digestion.

2. *Gastralgia* is manifested by paroxysms of pain independent of the ingestion of food. The attacks recur almost periodically and very often at night. Often they are relieved by pressure upon the epigastrium and after taking food. Gastralgia must often be differentiated from the crises of tabes, ulcer, and cancer of the organ and cholelithiasis.

3. *Bulimia* is a sensation of insatiable hunger coming on paroxysmally in nervous subjects on an empty or full stomach and attended with fainting, headache, palpitation of the heart, etc. In the polyphagia of diabetes the sensation of hunger occurs between meals. In *acoria* the sensation of satiation of the appetite is lost, and even after an abundant meal the patient feels "empty." The sensation of hunger in these cases is not augmented, and Fleischer associates the condition with an anesthesia of the sensory nerves of the stomach which normally apprise us of the sensation of satiation. In *anorexia* the appetite is either reduced or absent. In hysterical subjects this annihilation of appetite may be so pronounced that even attempts at feeding may be followed by spasms, and the patients rapidly emaciate, and may die if some radical measure like the rest-cure with isolation is not executed.

The Secretory Neuroses.—1. *Hyperacidity* or hyperchlorhydria is a frequent condition in gastric ulcer, but independent of the latter, it is one of the most common neuroses of nervous dyspepsia. It is manifested by pain after eating, pressure, fullness, pyrosis, bulimia, etc., and the attacks are benefited by bicarbonate of soda, which neutralizes the free hydrochloric acid.

2. *Supersecretion,* which is characterized either by a periodic or continuous flow of gastric juice. The periodic form (gastroxynsis) may occur independent of the time of digestion and often occurs in tabetics and neurasthenics. The attack is manifested by abnormal gastric sensations, headache, and pyrosis. The continuous form is more common and the stomach contains abundant quantities of gastric juice even when empty.

3. *Nervous subacidity* may occur either as a neurosis or it may be symptomatic of gastric cancer or catarrh. Absence of the gastric juice is known as *achylia gastrica,* and it may be due to total atrophy of the gastric mucosa or it may occur as an independent neurosis. Gastric symptoms of all kinds may be present, but the digestive secretions of the intestines may vicariously substitute the lost gastric function. Atrophy of the gastric mucosa is usually the effect of a carcinoma of the organ or an aggravated gastritis, but diabetes mellitus and visceral carcinoma elsewhere may conduce to the same condition. When the entire mucosa is atrophied, we can find no hydrochloric acid, pepsin, lab-ferment, or mucus in the stomach-contents. Achylia may present the symptomatic picture of pernicious anemia, and it is difficult to say whether the achylia is primary or secondary to the anemia.

Gastric Ulcer.—The etiology of ulcer has already been discussed (page 447). An ulcer is usually single, but many ulcers may be present (thirty-five). The usual situation is on the posterior wall of the pyloric portion, at or adjacent to the lesser curvature. Many theories exist concerning the pathogenesis of gastric ulcer, but all prove inadequate. There are no end-vessels in the stomach, hence interference with the blood-supply cannot explain its origin. Superacidity is almost invariably associated with ulcer, but what influence this hyperacidity may have on the origin of the ulcer has not been determined. The problem of immunity (page 267) has an important bearing on this subject, for it shows that within the body the production of harmful substances is associated with the creation of anti-substances which neutralize their effects, hence the stomach does not digest itself, nor for that matter the intestinal mucosa, owing to the production of an antipepsin and an antitrypsin. It has already been shown (page 447) that the diagnosis of ulcer is often made by the therapeutic results. A *duodenal ulcer* is usually located just outside the ring in the first portion of the gut, and in most instances it is practically impossible to differentiate it from a gastric ulcer because the symptoms correspond in both affections. Turck[229] has shown that by feeding dogs for variable periods with cultures of colon bacilli, round or peptic ulcers may be produced in the stomach and duodenum. Rosenau has shown that gastric ulcers may be produced experimentally in guinea-pigs by diphtheria-antitoxin injections, and, finally, Fütterer, by excising a small piece of gastric mucosa and maintaining a chronic anemia in animals, could also produce ulcers. As in these animals, anemia in human subjects is a potent factor in the etiology of gastric ulcer.

Carcinoma of the stomach is usually associated with an absence of free hydrochloric acid, but there are cases in which hyperchlorhydria is present. The amount of hydrochloric acid present depends on the catarrh and atrophy of the gastric mucosa. The cancer-cachexia is supposed to be due to deficient digestion, but it has been shown that in cancer of the organ ferments are produced which can decompose proteids even more rapidly than does the normal gastric juice. It is the severe anemia that accounts for the cachexia. The syndrome of carcinoma ventriculi is made up of vomiting (coffee-ground vomit), the presence of a tumor,—which is the most important symptom, but present in only from 50 to 60 per cent. of the cases,—absence of free hydrochloric acid in the stomach-contents, and the presence of lactic acid. The normal gastric juice owes its antiseptic properties to the presence of hydrochloric acid. Even though the latter is absent, bacterial decomposition of the stomach-contents does not occur provided the motility of the organ is unimpaired. When the motility of the organ has been compromised and hydrochloric acid is deficient or absent, putrefactive decomposition of proteid material and fermentation of carbohydrates occur as a result of gastric stagnation. Owing to the fermentation process, which is more frequent, sugar is converted into alcohol and carbon dioxid; alcohol into acetic and dextrose into lactic acid. Among the bacteria present there is one, the Boas-Oppler bacillus, which is responsible for the formation of lactic acid. The demonstration of large quantities of lactic acid in the stomach is an important sign in carcinoma, and the same may be said of the Boas-Oppler bacillus, which is made up of long rods joined by their ends and stainable by the anilin dyes (Fig. 139). This bacillus is found in about 80 per cent. of the cases of carcinoma of the stomach, and rarely in dilatation of the organ from non-malignant pyloric obstruction. The leptothrix buccalis, found in the mouth, is stained blue and the Boas-Oppler bacillus brown with Gram's solution. The latter solution consists of iodin, 1 part, potassium iodid, 2 parts, and water, 300 parts. Among the other tests for carcinoma is the demonstration of occult blood (page 448) in the feces or stomach-contents.

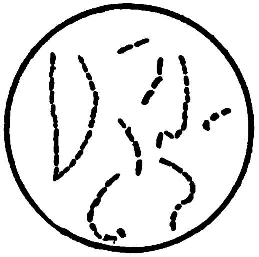
Fig. 139.—Boas-Oppler bacillus.

Salomon's test for albumin is as follows: The patient takes only liquid nourishment for twenty-four hours, and then at noon he takes his last liquid meal, free from any albuminous food; at 8 o'clock in the evening the stomach is very carefully washed with water. The next morning the stomach is washed with a pint of physiologic salt solution. The same fluid is run in and out several times. This water is then tested for albumin by Esbach's test and for nitrogen by Kjeldahl's method. If the reaction for albumin is elicited, it is an indication in favor of cancer. The nitrogen in the norm does not exceed 16 milligrams per 100 c.c. of fluid, and Esbach's test shows only a slight cloudiness. In cancer cases, nitrogen ranges from 10 to 70 milligrams per hundred c.c. of fluid and albumin from $\frac{1}{10}$ to $\frac{1}{2}$ gram per mil.

"*Gluzinski's test* is based on the fact that a chronic mucous gastritis develops on the basis of an acid gastric catarrh during the transition of an ulcer into a cancer. If one can exclude the healing of the ulcer, we have a valuable test for the development of a cancer in an ulcer. The healing of an ulcer never gives rise to a mucous catarrh. The stomach is tested three times the same day, first rinsing it out fasting in the early morning, then three-quarters of an hour after a test-breakfast, and, finally, four hours after a beef-steak test-meal. When there is absent or very slight HCl in one of the tests, while after the other meals there is a strong HCl reaction, and if at the same time the long bacilli are present (though this is not indispensable), then the indications are strongly that the acid catarrh is beginning to change into a mucous catarrh and that a cancer has begun to develop in the floor of the ulcer" (McIntosh).

Motor Insufficiency.—The fundus of the normal stomach is the reservoir for the ingesta. The pylorus is closed and opens periodically when free hydrochloric acid is present in the stomach. Thus some of the acid-contents is discharged into the intestines, at which time duodenal irritation of the duodenal mucosa closes the pylorus and stimulates the flow of pancreatic juice. The latter by neutralizing the gastric contents again permits of relaxation of the pylorus, and more chyme passes into the duodenum. The movements of the stomach are probably not influenced by the acidity of its contents. Motor insufficiency exists when the stomach is incapable of fully discharging its contents. Dilatation of the stomach usually follows motor insufficiency. Dilatation may be acute (page 135) or chronic. The causes of the chronic form are: (1) Pyloric obstruction (cancer, cicatrized ulcer, hypertrophic pyloric stenosis); (2) insufficiency of the gastric musculature, due either to overfilling of the organ with food and drink or to atony of the muscular coat the result of chronic gastric catarrh and disturbances of nutrition (anemia, tuberculosis, etc.). A combination of the causes of the second group (catarrh and overloading) is observed in beer-drinkers. In the second group a distinction must be made between an enlarged (megalogastria) and a dilated (gastrectasis) stomach. The maximum capacity of a normal stomach is 1600 c.c., and a stomach capable of holding a large amount of fluid indicates absolute dilatation (Ewald). Motor insufficiency of the organ is associated with many nervous symptoms, and French observers have prepared from the stomach-contents of dilatation toxic extracts which will produce like symptoms.

TESTS FOR SUFFICIENCY OF THE STOMACH.

Position of the Stomach.—Methods for defining the position of the stomach have already been described (page 402). The position of the stomach in dilatation of the organ may be defined when the abdomen is soft and thin by external palpation of the tip of the elastic rubber tube in the stomach. When the stomach is high up in the thoracic cavity, the extensive tympanitic sound may conduce to an erroneous diagnosis of pneumothorax. By filling and emptying the stomach by aid of the stomach-tube, differences may be noted in the auscultatory and percussion phenomena if the tympanitic area in question is wholly due to the stomach. Another important aid is afforded by the *stomach-reflex* test: strong percussion of the pleximeter fixed over the area of tympany will show (if light percussion with the finger is employed) a modification of the sound (usually dullness) if the area in question is caused by the stomach, otherwise the percussion sound is unmodified. Strong percussion is made primarily by aid of the pleximeter and hammer (Fig. 27).

The capacity of the organ may be increased by a vegetable diet, and increased capacity only indicates that the organ is enlarged, but not necessarily diseased. Dilatation of the organ means enlargement, but the diagnosis of dilatation is not justified unless motor insufficiency coexists.

Motor Power.—This may be tested by the salol and iodipin tests (pages 266, 198). Splashing sounds in the gastric region indicate dilatation of the organ plus motor insufficiency if felt and heard at a time when the stomach should be empty, viz., seven hours after an ordinary meal and in the morning before breakfast. To elicit these sounds the patient is placed in the dorsal decubitus with one hand upon the epigastrium, and with the other hand the left hypochondrium or the lower left ribs are struck a series of blows or jarred. If a stethoscope is employed, the source of the splashing may be referred to the colon when it is filled with liquid feces and gas. If the splashing is of colonic origin, it is heard as well over the ascending colon, and diarrhea is usually present. When splashing is feeble, I employ a stethoscope which is fixed in the left hypochondrium. According to Rose, splashing heard during normal digestion indicates simple atony; produced after digestion is presumably terminated, it signifies motor insufficiency; and audible in the morning on an empty stomach, it means dilatation of the organ. The vomitus may also serve as an index of motor insufficiency if undigested food is present seven hours after an ordinary meal when the stomach is supposed to be empty, or if food known to be ingested the previous day is present. The motor power is also determined by means of a test-meal. Thus, if a stomach is not empty seven hours after a Leube-Riegel, and two hours after the Ewald test-meal, the motor power is insufficient.

Sufficiency of the pylorus is determined according to the method described elsewhere (page 550).

The Stomach Reflex.[191]—This reflex of contraction may be elicited in two ways: (1) By having the patient forcibly extend his head backward after the manner described for inhibiting the heart (page 534) and in making the tracheal traction test (page 305). This is a vago-visceral reflex, and is evoked by stimulation of the vagi in the neck by contraction of the musculature. (2) By placing the pleximeter in the Traube area and then striking the pleximeter a series of vigorous percussion blows. The Traube area contains the cardiac end of the stomach and is bounded above and laterally by the contiguous borders of the liver, lung, and spleen. By both methods percussion of the available stomach area yields a tympanitically dull sound, owing to increased tension of the gastric walls, which puts the gas or air within them under increased tension, thus translating a previously tympanitic into a dull sound. Before either method is executed, an attempt is made by percussion to define the lower border of the stomach, but, as a rüle, this is impossible, for one cannot differentiate the tympany of the stomach from that of the intestines. If, however, the first maneuver is executed, a slight dullness is elicited when the gastric border is attained during the time the head is forcibly extended, but the dullness disappears at once when the head is flexed. This maneuver defines the lower stomach-border without dislocation of the organ. By the second method the lower border of the organ is dislocated upward from about 2 to 4 cm. Both methods yield the best results with the patient in the erect posture. By the second method the motor power of the organ may be determined (Fig. 140). *A* (Fig. 140) signifies the lower stomach-border elicited by percussion during the time the head is forcibly extended; *B* signifies the lower border of the organ after concussion of the Traube area. The difference in the distance between the lines *A* and *B* represents the degree of stomach-contraction (2 to 4 cm. in the norm) and is in direct ratio to the motor power of the organ. In ulcer of the stomach there is usually a localized point of tenderness in the epigastrium. To determine whether this or any other tender area is associated with the stomach execute the second method of eliciting the stomach reflex, and if the area in question is connected with the stomach it will shift its position from X1 to X2 (Fig. 140). Within a minute (after the reflex is spontaneously abolished), the point of tenderness is again located at X1. The change back to X1 may be hastened by tapping the epigastrium, which induces the counter-reflex of stomach-dilatation. This maneuver may be an available method in the diagnosis of a duodenal ulcer, for the tender area of the latter, unlike that of an ulcer of the stomach, would not be dislocated. We would expect likewise no dislocation of the organ if perigastric adhesions are present.

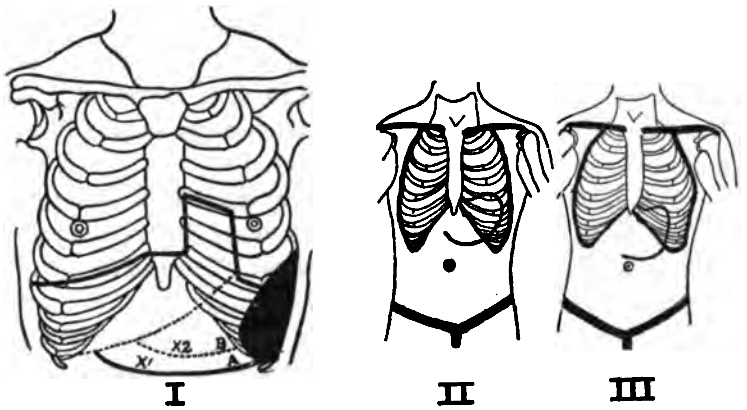

Fig. 140.—I, Illustrating the vago-visceral and concussional stomach reflexes of contraction. The shaded area represents Traube's space for concussion to determine the concussional reflex. X1, X2, represent a dislocated area of tenderness associated with the stomach. II represents the boundaries of the normal stomach elicited during the end of forced expiration, obtained by the vago-visceral reflex, and III shows a patient with gastroptosis.

Absorbent Power.—The power of absorption of the gastric mucosa is determined by means of potassium iodid (page 194).

Test-meals.—The quantity and quality of the gastric juice vary according to the amount and quality of the food, hence test-meals are given to secure uniform results.

1. *Ewald's test-breakfast* consists of one or two baker's rolls or one or two slices of dry bread and 300 to 400 c.c. of water or weak tea. This meal is taken in the morning, no food having been eaten since the previous evening. An hour or an hour and a half after the ingestion of the foregoing the contents of the stomach are withdrawn (pages 162, 164). After this breakfast the stomach should be empty two hours after; but if, however, after this time the expressed contents contain a considerable quantity of solid material, motor insufficiency exists, and with advanced grades of insufficiency food may be expressed for many hours after the ingestion of the test-breakfast.

2. *Von Leube and Riegel Test-dinner* consists of 400 c.c. of soup, a slice or two of wheat bread, 100 to 200 grams of chopped or minced beefsteak, and 200 c.c. of water. The gastric contents are withdrawn four hours after.

3. *Cranberry or currant test:* This is employed for determining motor sufficiency. The patient receives at his evening meal a tablespoonful of cranberry or currant preserves. If on the following day, the stomach contents contain any of the fruits or seeds (even though the patient has taken in the meanwhile his ordinary food), motor insufficiency exists.

The Fasting Stomach.—The normal stomach becomes empty within eight hours even after an abundant meal. Valuable information may often be obtained by expressing the contents of the stomach in the morning before breakfast, or at any other convenient time, provided no food has been ingested since the evening before. The presence of food eaten the previous day suggests motor insufficiency. Hypersecretion is diagnosed if the fluid in the stomach contains free hydrochloric acid. If bile is found, as determined by Gmelin's test (crude yellow nitric acid causes color changes, ranging from green to yellow), it may be due to the gagging caused by the use of the tube. Cells and other fragments suggestive of carcinoma of the organ may be obtained by washing the fasting stomach; sedimentation of the fluid is hastened by the use of the centrifuge.

Analysis of the Gastric Contents.—The following facts are determined by analysis: (1) The acidity; (2) the presence of hydrochloric and (3) of lactic acids; (4) the total acidity; (5) the digestive power of the gastric juice; (6) the character of starch-digestion; (7) the presence of rennin; (8) the presence of mucus.

When digestion is at its height, the following constituents may be demonstrated in the normal stomach: free hydrochloric acid, acid salts, pepsin, rennin, albumoses and peptones, maltose and its related substances. After the fluid is withdrawn from the stomach, it is filtered through paper or muslin, and with the filtrate the analysis is made.

1. *The Acidity.*—The normal or abnormal gastric juice is practically always acid in reaction, as determined by blue litmus paper turning red. The acidity may be due to free acids, combined acids, or acid salts. If a strip of Congo-red paper is dipped into the filtrate and it turns blue, then free acid (hydrochloric or some organic acid) is present. Now, certain tests will determine whether the acid is hydrochloric or lactic. We may disregard acetic and butyric acids, as they are usually products of fermentation and have practically the same diagnostic value as lactic acid. Taussig and Rush show that the removal of the stomach-contents in the usual way after test-meals does not represent the acidity of the contents as a whole, insomuch as if the contents are removed first in the erect and then in the recumbent posture, the acidity differs in both portions, hence the contents must first be aspirated in the erect and then in the prone posture and the degree of acidity compared.

2. *Hydrochloric Acid.*—Günzburg's reaction is the most sensitive and positive reaction for free hydrochloric acid. The reagent consists of phloroglucin, 2 grams, vanillin, 1 gram, and alcohol, 300 grams; 1 or 2 drops of this solution are placed in a porcelain dish with a like amount of the gastric filtrate and the plate is gently warmed over a flame. In the presence of free acid (hydrochloric) a carmin-red color develops when the fluid is evaporated. A brown or yellow color indicates either overheating

or the absence of free hydrochloric acid. To determine the percentage of hydrochloric acid (the normal is 0.1 to 0.2 per cent.), fill a graduated buret with a decinormal solution of sodium hydrate (4 grams to 1000 c.c. of water)* and then add to 10 c.c. of the gastric filtrate about 3 drops of a 0.5 per cent. solution of tropeolin, which colors the solution red owing to the presence of hydrochloric acid. The sodium hydrate solution is then added drop by drop to the gastric filtrate until a yellow replaces the red color, showing that all the hydrochloric acid has been neutralized. One c.c. of the sodium hydrate solution will neutralize 0.00365 gram of hydrochloric acid, hence if the buret shows that 3.6 c.c. of the sodium solution were required, the amount of hydrochloric acid in 10 c.c. of gastric juice would be: 0.00365 × 3.6 = 0.01314 gram, and the percentage amount in 100 c.c. would be 0.01314 × 10 = 0.1314.

3. *Lactic Acid.*—Uffelmann's test is quite sensitive, and the reagent, which consists of the following, must be freshly prepared for each test: Place in a test-tube 3 drops of liquefied carbolic acid and 3 drops of a saturated aqueous solution of the sesquichlorid of iron. This solution is diluted until the color becomes a transparent amethyst blue. In a large test-tube 50 c.c. of ether are added to 10 c.c. of the gastric filtrate; shake the tube for several minutes and pour off the ether which has extracted the lactic acid. After evaporating the ether by immersing the test-tube in hot water, the ether residue is dissolved in about 5 c.c. of water, and if a little of this ethereal extract is added to the reagent, the blue tint of the latter changes to a canary-yellow if lactic acid is present.

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* A decinormal solution of soda is equivalent to 4 grams of sodium hydrate dissolved in 1000 c.c. of distilled water, and each cubic centimeter of this solution exactly neutralizes 0.00365 gm. of hydrochloric acid. I have frequently resorted to a rough test for determining whether the hydrochloric acid is plus or minus without making a quantitative analysis. In the phloroglucin-vanillin test the intensity of the redness is in direct proportion to the amount of acid. The maximum degree of acidity of the stomach-contents is attained about five hours after Leube's experimental meal, and is equivalent to from 0.15 to 0.2 per cent. of hydrochloric acid. Whenever the latter is more than 0.3 per cent., it is considered pathologic; hence have always in readiness two solutions of hydrochloric acid (0.15 per cent. and a 0.3 per cent.), and by making the test with either of these stock solutions the depth of coloration may be compared with that of the acid obtained from the stomach-contents.

4. *The Total Acidity.*—This indicates the acidity of the free and combined hydrochloric acid, the organic acids, if present, and the acid salts. The normal total acidity is 40 to 60. In titration of the total acidity of the gastric juice the normal soda solution (*vide* hydrochloric acid) is used, but as an indicator, phenolphthalein is used instead of tropeolin. About 3 drops of a 1 per cent. alcoholic solution of phenolphthalein are added to 10 c.c. of gastric juice. To the latter solution in a test-tube the normal soda solution is added drop by drop and after each addition the tube is shaken. It will be noted that after each drop of the soda solution is added to the gastric juice a rose color appears, but this disappears after each shaking of the test-tube. Eventually, however, the rose color becomes permanent, and cannot be dispelled by shaking the tube. When the rose color assumes a dark-red hue, then the gastric juice has been neutralized. If 6 c.c. of the normal soda solution were required to neutralize 10 c.c. of the gastric juice, then ten times this amount would be necessary to neutralize 100 c.c., hence 6 × 10 = 60 = the total acidity.

5. *The Digestive Power.*—If hydrochloric acid is present in the gastric juice, it may generally be assumed that pepsin is likewise present. To test the digestive capacity of the gastric fluid, take two test-tubes containing the same amount (25 c.c.) of the gastric juice. Into each tube introduce one grain of the white of a hard-boiled egg, and into one of the tubes a few drops of a 1 per cent. solution of hydrochloric acid. Both tubes are then placed in a water-bath and kept at a temperature of 37° to 40° C. In the norm the coagulated albumin is digested within three hours. If the albumin in neither tube is dissolved at the end of this time, pepsin is either deficient or absent; if the albumin in the tube containing the acid is alone digested, then the gastric fluid contains pepsin but no hydrochloric acid.

6. *Starch-digestion.*—This occurs in the mouth and stomach. The starch is converted successively into soluble starch (amylodextrin), erythrodextrin, achroödextrin, and maltose. A drop of Lugol's solution (iodin, 1 part, potassic iodid, 2 parts, and distilled water, 200 parts) added to the gastric filtrate gives a blue color if starch is present (and therefore undigested), a violet color with amylodextrin, a reddish or mahogany-brown color with erythrodex-

trin, whereas the last two products (achroödextrin and maltose) yield no characteristic colors. Maltose reduces Fehling's solution.

7. *Rennin.*—If to 5 c.c. of milk 3 drops of the gastric filtrate are added and the whole kept at a temperature of 37° to 40° C., coagulation occurs within fifteen minutes if rennin is present.

8. *Mucus.*—This is always present in the gastric juice as cloudy flakes, which are very small if the conditions are normal. Swallowed mucus from the nasopharynx and bronchial tubes forms larger masses and contains more pus-corpuscles than does the mucus of the stomach. Mucus cannot be detected quantitatively by chemic means because mucin is dissolved in a gastric juice containing hydrochloric acid, and when it is digested, it is not precipitable by acetic acid. Fischer uses the following test for mucus in the stools and in the stomach-contents: 5 c.c. of filtered gastric contents are thoroughly shaken with a 5 c.c. alcoholic solution of bichlorid of mercury and 10 drops of Ehrlich's triacid stain. All mucus and proteids are precipitated. Filter and wash the precipitate on the filter with water. If there is much mucus, the precipitate will remain a dark green; if composed of acid-albumin, it will be red or purple and is soluble (mucus insoluble) in a 25 per cent. solution of acetic acid. A normal fasting stomach contains little or no mucus. Following a test-meal, a moderate amount of mucus is present.

Conclusions.—1. The gastric juice may be absent (achylia gastrica) in atrophy of the gastric mucosa or it may occur as a neurosis. The fluid in the stomach contains no hydrochloric acid nor ferments. Subacidity may be present, and in other instances there is no free acid, but pepsin and rennin may be demonstrated. In nervous achylia hydrochloric acid and the ferments may be present at one time and absent at another time.

2. When hydrochloric acid is normal in amount (0.1 to 0.2 per cent.) one hour after the test-breakfast, the condition is known as euchlorhydria, to distinguish it from a pathologic increase (hyperchlorhydria), decrease (hypochlorhydria), or absence (anachlorhydria).

3. Hyperchlorhydria is present when the free hydrochloric acid after an Ewald's test-breakfast is in excess of 0.2 per cent. and the total acidity in excess of 70. Hydrochloric acid is in excess

in ulcer of the stomach, in gastric neuroses, and in chronic catarrh (early stages) of the organ. When the acid is increased, the condition is known as hyperacidity, but if to this is added an increase in the quantity of gastric juice, the condition is known as hypersecretion. If the gastric fluid in the fasting stomach of the morning contains hydrochloric acid, hypersecretion is assumed to exist.

4. Hypochlorhydria (less than 0.1 per cent.) occurs when the secreting glands of the gastric mucosa have been partially destroyed or have become functionally impaired. It is present in cachectic and anemic conditions, chronic gastric catarrh (later stages), neurasthenia, after prolonged use of alkalies and saline purgatives, and in chlorin hunger.

5. Anachlorhydria. Hydrochloric acid is absent in the majority of cases of cancer of the stomach, and if lactic acid is present in considerable amount and the Oppler-Boas bacillus can be demonstrated, the diagnosis of cancer is fortified. Hydrochloric acid is also absent in infectious diseases, atrophic gastric catarrh, and pernicious anemia. Freidenwald and Rosenthal have noted that hydrochloric acid is also diminished or absent when carcinoma is present in organs remote from the stomach.

6. Lactic acid. This is usually present when hydrochloric acid is absent and motor insufficiency coexists; hence atrophy of the gastric mucosa and stagnation from slight or severe grades of pyloric stenosis favor the development of lactic acid, and as the latter conditions are present in gastric carcinoma, the demonstration of lactic acid in the gastric contents is a valuable aid in diagnosis. Now, Ewald's breakfast may yield a small amount of lactic acid, and hence, to avoid this remote source of errror, it is best to employ the Boas test-breakfast when the symptoms suggest gastric cancer. The Boas breakfast eliminates all lactic-acid-forming substances and consists of a gruel made of a tablespoonful of oatmeal flour in a quart of water and boiled down to one pint. A little salt may be added, but nothing else. The stomach is washed on the previous night and the patient takes his test-breakfast in the morning, and in an hour and a half afterward the contents are removed.

7. Demonstration of the presence or absence of *pepsin* is of importance in diagnosis. Thus, the neuroses and circulatory

disturbances may modify the secretion of hydrochloric acid, but their influence on pepsin is comparatively slight, hence the absence of the latter is more likely to signify atrophy of the gastric mucosa, and would speak in favor of an organic as against a functional disturbance. The same argument applies to rennin.

8. An abundance of *mucus* in the gastric contents is characteristic of gastric catarrh. The amount of mucus may seem to be increased in gastric cancer because the mucus swells in anachlorhydria. An excess of mucus may indicate a neurosis, and in this respect it is likened to membranous enteritis.

9. *Starch-digestion* is arrested, according to Boas, when the gastric fluid contains 0.15 per cent. of hydrochloric acid, hence the degree of starch-digestion may serve as an index of hydrochloric acid secretion. Lactic acid has less influence in arresting starch-digestion.

THE INTESTINES.

Physiology.—The intestinal canal is differentiated into the small and large intestine, from their difference in diameter. They are continuous and communicate with each other by an opening guarded by the ileocecal valve, which allows the passage of digestive products from the small into the large intestine. The action of the pancreatic juice and bile has already been discussed and the *succus entericus* demands brief consideration. Heretofore little importance was attached to the latter juice, but recent investigations show that not only can it convert starch into sugar by means of its ferment (invertin), but that it aids the proteolytic action of the pancreatic juice, which alone has no digestive action on proteids. Similarly, the succus entericus alone has no proteolytic (digestion of proteids) activity. The ferment of the intestinal juice which aids tryptic activity is known as enterokinase. It is also known that bile itself has little digestive action, and it is only when combined with the pancreatic juice that its action in digestion is manifested, and this refers in all cogency to the digestion of fats which are undigested in the feces when bile fails to enter the duodenum. Thus we note that digestion is not a series of isolated phenomena, but that one digestive fluid is reinforced by the other. Thus when the acid juice of the stomach enters the intestine it produces secretin; the latter is conveyed to the pancreas by the circulation and increases the flow of pancreatic juice. Fatty acid is liberated from the bile, which produces more secretin, and consequently more pancreatic juice, but the latter requires enterokinase from the succus entericus to digest proteids.

An ordinary meal passes through the small intestine in about twelve hours, and through the large intestine in from twenty-four to thirty-six hours. The intestines are endowed with alternate contractions and dilatations of the muscular coats (peristalsis), and they give rise to no sensations in health. The movements may be from below upward (antiperistalsis), but the passage of the contents of the large into the small intestine is prevented by the ileocecal valve. The muscular fibers of the large are stronger than those of the small intestine, and they attain the greatest strength in the rectum, at the termination of which a strong band is formed called the internal sphincter (unstriped fibers), and lower down, the external sphincter (striped fibers), which is in a state of moderate tonic contraction. Experimental irritation of the central nervous system is without any apparent influence on peristalsis, yet we know how mental conditions may either retard or accelerate peristalsis. The vagi and splanchnic nerves connect the small intestine with the central nervous system and stimulation of the vagi induces peristalsis. Peristalsis may be induced in the small intestine by pinching any particular spot of the intestinal wall, even though all the nerves connecting the intestines with the central nervous system have been divided. Irritation of the splanchnic nerve suspends the intestinal movements. Between the longitudinal and circular muscular layers of the intestinal wall is the plexus myentericus, which is the anatomic center of intestinal peristalsis. The plexus is stimulated by blood containing CO_2 in excess.

Food stimulates the normal peristalsis, and no movements are in evidence when the intestines are empty. Starling has directed attention to other intestinal movements, from side to side (pendulum movement), and they effect a mixing of the intestinal contents, but are not able to move the contents onward, like the peristaltic movements. While the latter movements are inhibited by painting the intestinal mucosa with cocain, the pendulum movements continue.

Pathologic Physiology.—This subject has been partially discussed elsewhere (page 124 *et sequentia*). Here the *intestinal neuroses* will be the subject of brief consideration.

The *motor neuroses* are: (1) Nervous diarrhea; (2) peristaltic unrest; (3) enterospasm; (4) nervous constipation.

1. *Nervous Diarrhea.*—This condition presumes an absence of all anatomic changes in the intestinal wall. The subjects of this affection are usually neuropaths, in whom the diarrhea may be merely an expression of dyspepsia, or, occurring independently of the latter, it is easily influenced by a variety of psychic factors. The diarrhea during dentition is regarded by many as nervous unless it is associated with dyspeptic symptoms. In hysteria nervous diarrhea is a frequent symptom. It also occurs in tabes, but in my experience it is more often the result of a relaxed or paralyzed sphincter ani; in fact, I have frequently noted such relaxation of the sphincter in many so-called cases of nervous diarrhea.

2. *Peristaltic Unrest.*—In this condition (tormina intestinorum) patients suffer from loud noises, which may often be heard by others. The peristaltic movements may be so loud as to interfere with the sleep of the patient. They are often visible to the physician and may be palpated. The rolling movements are usually limited to the small intestine, and obstinate constipation is often present. The condition may be associated with peristaltic unrest of the stomach (page 853).

3. *Enterospasm.*—Reference has already been made to spastic constipation (page 292). In enterospasm the intestinal spasticity may be limited or diffused, and in the latter instance the abdomen is retracted (scaphoid) and is observed in meningitis, hysteria, and plumbism. Constipation and intestinal pain (enteralgia) are almost invariable symptoms. In not a few instances constipation is essentially a neurosis dependent on enterospasm, and the employment of opium in such cases is practically a specific. In other words, however paradoxical the statement, opium may be regarded as a laxative. In very small doses it may be added as an adjuvant to the purgative class of drugs, and in this respect I

have found it even more efficient than belladonna. Spasm of the *sphincter ani* (proctospasm) may occur independently, or is associated with enterospasm. Here the spasmodically contracted anus prevents the introduction of the finger, and very often the patient must be put under the influence of an anesthetic to determine whether local lesions (hemorrhoids, fissure, proctitis) are responsible for the proctospasm. Proctospasm may prove an etiologic factor in some cases of constipation, although as a cause it is unquestionably exaggerated. Gradual dilatation of the anus, which has been suggested for its relief, cures constipation by mechanic irritation of the rectal mucosa plus the psychic effects. I have found that the rectal mucosa on palpation shows a diminished sensibility in some cases of chronic constipation. In such instances any local mechanic irritant, by arousing the dormant sensibility, will augment the rectal reflex and thus render the patient conscious of stagnant feces.

4. *Nervous Constipation.*—This is often associated with atony of the intestines and the subjects are usually hysterical and suffer paroxysmally from meteorism. In the norm the intestinal gases are derived from swallowed air and intestinal decomposition, and are often dependent on the quantity and quality of the ingested food. There is always a tendency to meteorism whenever there is any weakness of the intestinal musculature, and it is assumed that in hysteria this condition is present. We must also remember that large amounts of air are swallowed (aërophagy).

The *sensory neuroses* are: (1) Enteralgia; (2) neuroses of secretion.

1. *Enteralgia.*—This is quite independent of the colicky pains described in enterospasm and caused by a tetanic contraction of the enteric musculature. Here the sensory nerves are involved and the patient complains of severe abdominal pains of a tearing or cutting character. These pains must be differentiated from the pains occurring in inflammatory abdominal affections. Usually the pains of the former are relieved, and of the latter increased by abdominal pressure. The etiology of enteralgia is usually made up of two factors: a hysterical subject with hyperesthetic intestines, and an irritant, usually intestinal (worms, undigested or irritating food). Enteralgia may be associated with hyperesthesia of the

abdominal wall, constituting the picture known as hysterical peritonitis. It is easy to say that the severe pain felt when the skin is pinched and the fact that deep abdominal pressure is no more painful than superficial pressure will exclude peritonitis, but even the most experienced clinicians have erred in their diagnosis.

2. *Neuroses of Secretion.*—It is reasonable to assume that intestinal are equally as common as the secretory neuroses of the stomach. Mucous colitis, observed in nervous and hysterical subjects in whom large quantities of mucus and intestinal casts are periodically evacuated, is probably a secretion neurosis of the large intestine.

Intestinal vertigo is observed in some patients with intestinal disease, and Leube was able to induce vertigo in one of his patients by a digital examination of the rectum.

TESTS FOR INTESTINAL SUFFICIENCY.

Motility.—The motility of the intestines can be determined by the black color of the feces after the administration of charcoal (page 290).

Intestinal Digestion.—This may be determined by glutoid capsules containing iodoform (page 197). The glutoid capsule determines the activity of pancreatic digestion and the absorptive power of the intestine. To estimate the latter alone, iodoform may be given on an empty stomach without the capsule. Salol (page 266) may also be used with the same object in view. The method of Boas of obtaining *intestinal juice* (pancreatic juice, bile, and succus entericus) is based on the fact that moderate straining will often cause the duodenal contents to pass into the stomach. The method has not been sufficiently elaborated to be of practical value, hence the reader is referred to the several original contributions on the subject.[192]

Examination of the Feces.—The *test-diet* of Schmidt[193] must be given, and it is as follows:

Morning: ½ liter (¾ pint) of milk or the same amount of cocoa (made with cocoa powder 20 grams, sugar 10 grams, milk 0.1 liter, and 0.4 liter water) and 50 grams rusk.

Before noon: ½ liter gruel (made with 40 grams of groats, 10 grams butter, 200 grams milk, one egg, and 300 grams water).

Noon: 125 grams minced beef lightly fried (so as to be raw inside) in 20 grams butter, 190 grams potatoes mashed with 100 grams of milk and 10 grams butter.

Afternoon: The same as in the morning.

Evening: The same as in the forenoon.

The diet represents 2234 calories, and consists in all of 1½ liters milk, 100 grams rusk, 2 eggs, 50 grams butter, 125 grams minced meat, 190 grams potatoes, and 80 grams oatmeal. Before giving the diet the stools must be examined for mucus and irritating matter, but under the test-diet the latter disappear. Examination for undigested food is not made until after the second or third motion, at a time when it is certain that they show the characteristic appearance (even consistency and lighter color) of the test-diet. Usually the test-diet is given for three days, or, at all events, long enough to be sure that the stool is obtained with certainty from this diet. With a normal evacuation the latter occurs with the second defecation after the commencement of the diet. Although the test-excrement is easily recognized by the even consistency and lighter color, it may be separated from the excrement of the former diet by giving at the beginning and end of the test-diet a wafer containing 0.3 gram of powdered carmin, which gives a distinguishing color to the corresponding part of the feces. Serious cases are kept in bed. Patients treated at home may be supplied with test-glasses (15 cm. in height and 8 cm. in diameter) having screw-top glass covers, and they should be sent for examination after each evacuation.

Macroscopic Examination.—This constitutes the most important part of the examination and establishes the consistency, color, and odor of the feces. After mixing the motion with a wooden spatula, an amount equal to the size of a walnut is put in a grater and ground down with a glass pestle, with a gradual addition of distilled water, to an absolutely fluid mass. This in turn is poured on a large black plate. In a normal motion only remnants of cellular particles (rusk, gruel, cocoa) are recognized. The pathologic remnants are: (1) Connective tissue and tendons from the minced meat, which are distinguished from mucus by the yellow color, fibrous form, and firm consistency. A drop of acetic acid causes the disappearance of the filamentous structure, whereas mucus becomes visible. (2) Remnants of muscle look like brown-colored splinters of wood. The muscular structure is recognized microscopically. (3) Remnants of potato and sago may be mistaken for mucus, but they are globular and of harder consistency. Microscopically the potato-cells are either empty or filled with bluish (when stained with iodin) colored starch-granules.

Mucus.—Roberts,[253] referring to the presence of mucus found in the stool on macroscopic inspection, observes that it constitutes evidence of inflammation of the intestinal tract, there being only two exceptions to this rule: the first is in the form of a thin, glistening coat of mucus on a hardened cylinder of fecal matter due to somewhat long retention within the rectum. The true cause of this mucus is evident if a softer mass fails to show such mucous coating. The second exception is found in the seemingly mucous masses of membranous colitis, which in fact is not a true inflammation. An evacuation of pure mucus indicates a catarrh of the descending colon, sigmoid, or rectum, accompanied by defecation so frequent as to prevent fecal admixture from the bowel above. With subsidence of inflammation fecal matter is added to the mucus, but not intimately mixed with it. When there are frequent passages of thin feces, with small masses of mucus, in lumps or shreds, intimately mixed with the feces, there is acute inflammation of the upper and lower portions of the colon. The higher the site of inflammation, the finer will be the subdivision of the mucus, and the more intimately will it be admixed with feces. Its detection then necessitates the use of what Roberts calls the "glass plate" test. Small fecal portions are rubbed up with water and spread out between glass plates of liberal size. If these be held to the light, very small particles of mucus are discoverable. He notes that mucus from the upper part of the colon and the small intestine is not ordinarily distinguishable with the naked eye. In acute catarrhal inflammation of the lowermost portion of the colon a few flakes of blood may be seen, but when there are evident streaks of blood intimately intermixed with the mucus, an ulcerative condition is indicated. The presence of purulent fluid mixed with the mucus has a like significance, but indicates a deeper destruction of tissue. The passage of large shreds of tough exudate resembling diphtheric membrane rather than true mucus is attributed not to inflammation, but to a secretory neurosis of the intestines. These shreds and casts may be found in the feces without a history of true intestinal colic.

Microscopic Examination.—This confirms or completes the macroscopic examination. Three preparations are made and

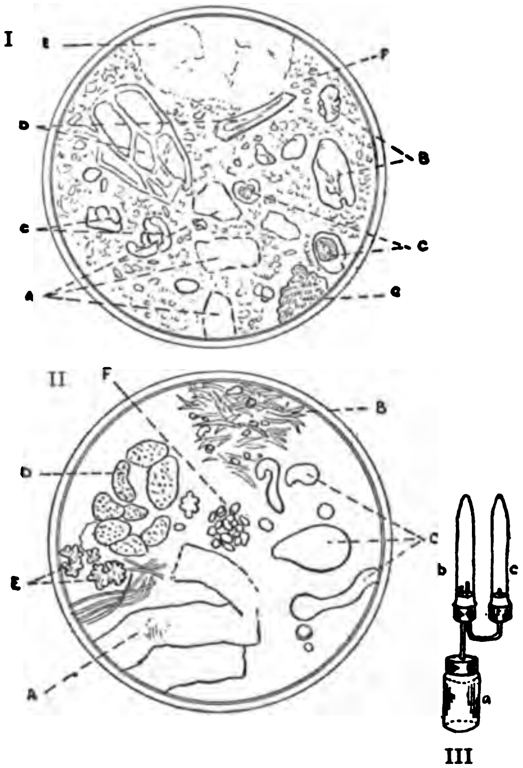

Fig. 141.—Normal test-diet feces (combined picture) (Schmidt). Leitz, obj. 7. I: *A*, Muscle-fiber remains; *B*, calcium salts; *C*, soaps; *D*, chaffy remains; *E*, empty potato-cells; *F*, detritus; *G*, cocoa remains. II: Pathologic ingredients. *A*, large muscle-fragments; *B*, fatty acids and soap-needles; *C*, neutral fat; *D*, starch-granules in potato-cells; *E*, granulose spherical and thread-fungi; *F*, yeast-cells. III: Fermentation tubes, after Strasburger.

distilled water is used when the ground-up feces are too hard: (1) This preparation consists of a particle of fecal matter placed on a slide and pressed by a cover-glass into a thin layer. (2) This is rubbed up with a drop of 30 per cent. acetic-acid solution and held over a flame until it commences to boil. (3) The last preparation is rubbed up with a drop of the following solution: iodin 1, iodid of potassium 2, and distilled water 50 parts.

Normally the three preparations show the following (Fig. 141):

Specimen 1: Muscular fibers (*A*) yellow in color, round edges, and perhaps indications of transverse striæ. Yellow salts of calcium flakes (*B*) consisting of fatty acid salts of calcium. Colorless soaps (*C*). Isolated potato cells (*E*). Remains from the oatmeal gruel (*D*) and remains of cocoa (*G*) when the latter is taken in place of milk.

Specimen 2: Here the fat is melted and the entire fat-content is seen after cooling as small flakes of fatty acids scattered over the entire preparation. If the preparation is again heated and examined while still hot, the microscope shows that the fatty acid is melted into drops which congeal when the preparation cools.

Specimen 3: This is stained brown by the iodin and the potato-cells are violet (not blue) and violet-colored sporules (clostridium butyricum) may be found.

Pathologically the three specimens show (Fig. 141, II):

Specimen 1: Muscular fragments (*A*) in larger number and in a better state of preservation. Drops of neutral fat (*C*). Needles of fatty acid and soaps (*B*). Potato-cells (*D*) with well-preserved starch-cells. Eggs of parasites.

Specimen 2: Massive fatty acid flakes, so that in comparison the remaining components form a very slight part.

Specimen 3: Blue colored remains of starch granules (*D*) either free or in the potato-cells. Blue or violet fungus spores and thread-like bacilli. Yellow colored yeast-cells (*F*).

Chemical Examination.—The normal reaction of the feces is feebly acid or alkaline and at times amphoteric (affecting both red and blue litmus). The test is made with blue and red strips of litmus paper, which are placed on, but not in, a portion of the feces mixed with distilled water. A marked deviation of the reaction is pathologic.

The sublimate test consists in placing some of the feces, ground up with water, in a glass vessel filled with a concentrated watery solution of $HgCl_2$, and after stirring it allowing it to stand until the following day. In the norm the feces are colored red by the normal coloring-matter, hydrobilirubin; and the fresher and less decomposed the stools, the deeper will be the color. The green coloring of a part of the feces is pathologic, observed either macroscopically or microscopically, and indicates unchanged biliary coloring-matter (bilirubin) in the feces. The *incubator test* is made with the fresh excrement (stirred but not thinned with water), and an amount taken equal to the size of a little walnut (about 5 grams). The latter is placed in the lower vessel of Strasburger's fermentation tube (Fig. 141, *a*), where it is stirred up with water, and the rubber stopper is put on carefully to exclude air-bubbles. From the little tube (*b*) the stopper is removed, and the tube is filled with tap-water. It is then closed by putting on the stopper with the vessels connected with it, *a* (filled) and *c* (empty); *c* has an opening on top and acts as an ascension-pipe. Note is taken of the figure indicating how far the connecting glass tubes enter into the lumen of the three vessels. After the apparatus is connected it remains in an incubator heated to 37° C. for twenty-four hours. If within this period gas developed from the feces collects in *a* or *b*, a corresponding amount of water is driven into the ascension-pipe (*c*). The height of water in the ascension-pipe is noted, the vessel *a* is opened, and the reaction of it is tested with litmus paper, and compared with the reaction before the test was made. In the norm little gas is formed and no change is noted in the reaction of the feces. If gas develops to such an amount that one-third or more of the ascension-pipe is filled with water, then pathologic conditions are present, and if the reaction has become more acid, carbohydrate fermentation has occurred. If it has become more alkaline, albumin putrefaction has occurred.

Conclusions.—1. Connective-tissue remnants indicate a digestive disturbance, insomuch as only the gastric juice dissolves raw connective tissue. This anomaly of gastric digestion may indicate diminution or absence of hydrochloric acid, and even though the latter acid is present, the raw tissue fails of digestion owing to an insufficient pepsin secretion.

2. Meat-fiber is usually digested in the small intestine, hence if the muscle-remnants are in excess, intestinal indigestion is present. The presence of both connective tissue and muscle-remnants indicates gastric and intestinal dyspepsia.

3. Every stool contains fat in the norm (23 per cent. of the

dry substance), but a morbid increase is recognized macroscopically by the clayey quality of the light-colored, nearly white feces, which are abundant and acid in reaction. Feces containing an excess of fat when rubbed up with water show a membrane on the surface. Microscopic examination in these instances of excessive fat shows an increase of flakes of fatty acid in the heated acetic acid preparation (specimen 2), and by drops of neutral fat or of fatty acid and soap-needles (specimen 1). Fatty stools occur: (*a*) When the bile is deficient. Here the sublimate test shows little or no red coloring of the feces. (*b*) When the pancreatic secretion is deficient. Here the fat is present in drops and muscle-remains may be recognized. Hydrobilirubin is also present. (*c*) When biliary deficiencies and pancreatic diseases can be excluded, interference with fat-absorption may be caused by severe forms of intestinal disease (tuberculosis, amyloid disease, tabes mesenterica). In the latter instance albumin-digestion is disturbed. Impairment of fat-absorption is, in rare instances, a functional disturbance, but the presence of mucus and the demonstration of decomposition indicate an organic intestinal disease.

4. When the sublimate test shows the complete absence of red or green coloring, bile is not present in the intestine (and icterus exists). If icterus does not exist, then there is a temporary suspension of biliary secretion. An absence of red coloring in fresh stools indicates intestinal decomposition. Green coloring macroscopically or microscopically of muscle-fibers or other fecal components indicates a too rapid passage through the colon, and if the entire stool shows this coloring, the small intestine is equally involved.

5. Carbohydrate indigestion is demonstrated by an abundance of bluish-colored starch grains (microscopically). Normally the potato-cells are violet-colored. In this form of indigestion the fermentation reaction is more pronounced and minute fungi or granulose spores may be seen microscopically. Even macroscopically, the stools in carbohydrate indigestion are light brown, frothy, and acid in reaction. Even though the fermentation test is negative, the macroscopic and microscopic signs just mentioned suffice to indicate indigestion of the carbohydrates or, as Schmidt calls it, fermentative dyspepsia.

Einhorn employs the following test for determining the functions of the intestinal tract: Patients are given, in a gelatin capsule, a string of beads with the following substances attached thereto: catgut, fish-bone, meat, thymus, potato, mutton-fat. After the capsule is administered, every stool is examined with the stool-sieve until the bead-string can be seen. In the norm the string appears after one or two days. It is then rinsed in water and examined. In the norm the catgut, meat, and potato (except the skin) disappear entirely; the thymus and fat almost entirely, whereas the fish-bone may be present or absent. The nuclei of the thymus always disappear. In pathologic conditions there is a delay in the recovery of the beads and in the digestion of the attached foods.

Uncinaria.—The following simplified method of finding the ova of uncinaria has been suggested by Bagby.[285] Mix thoroughly one-third of a teaspoonful of hard feces in about a pint of water. After this has stood for about five minutes the ova will have settled to the bottom. Pour off the clear liquid, leaving about one ounce in the bottom of the graduate. Wash the sediment in this manner three or four times, and then strain through cheese-cloth or gauze. If the mass does not run through freely, press it with a glass rod. After rinsing, let it settle for a few minutes, and then draw up a small quantity from the very bottom of the graduate with a medicine-dropper. In a few minutes the ova will have settled at the bottom of the dropper. Put a drop on a slide and cover with a slip. By gentle pressure on the cover-slip the drop will become thin enough to be examined. The ova are readily recognized under a $\frac{2}{3}$-inch objective.

THE BLOOD.

Physiology.—The solid particles suspended in the plasma of the blood are red and white corpuscles and blood-platelets. The *red corpuscles* are circular, biconcave discs with rounded edges, $\frac{1}{3200}$ inch in diameter and $\frac{1}{12000}$ of an inch in thickness. There are, on an average, in man 5,000,000 of these corpuscles per cubic millimeter. The chief constituent of the corpuscles is the pigment (hemoglobin), which contains about 0.4 per cent. of iron. Hemoglobin combines with oxygen to form oxyhemoglobin. In every blood there are a certain number of corpuscles smaller than the rest, known as microcytes or hematoblasts, and they are probably immature corpuscles. Many reagents produce changes in the shape of the corpuscles and cause them to discharge their pigment. Physiologic saline solution produces no effect on the corpuscles. The *white corpuscles*, or leukocytes (when at rest), are spherical masses of granular protoplasm with one or more nuclei, and they average $\frac{1}{2500}$ of an inch in diameter. The proportion of white to red corpuscles averages 1 to 500 or 600. The number of the latter varies with the character of the food ingested, and they are increased after eating and diminished by fasting. The property of the white corpuscles of spontaneously changing their shape is known as ameboid movement. The latter movement enables the leukocytes to ingest and digest bacilli, a process known as phagocytosis. The emigration of white corpuscles (diapedesis) noted in health, but more particularly in inflammation, is an active process, and the emigration of the red corpuscles is a passive process and is only observed in inflammation. The *blood-platelets* are colorless, disc-shaped or irregular bodies, smaller than the red corpuscles. Their origin is in doubt, and the theory that they were immature red corpuscles has been abandoned. The *origin* of the red corpuscles is referred chiefly to the medulla of bone and from the tissue of the spleen. The red marrow of bones, especially of the ribs, contains large pale cells which become colored from the formation of hemoglobin in one part of their protoplasm. The colored part separates from the rest of the cell and forms a red blood-corpuscle. There are also smaller ameboid cells (erythroblasts) in the marrow which become colored with hemoglobin, and after division and multiplication they lose their nuclei and are transformed into red corpuscles. Colored and colorless corpuscles are formed in the spleen from cells similar to the erythroblasts of red marrow. The red corpuscles after having outlived their usefulness undergo disintegration in the liver and spleen. The origin of the white corpuscles has not been determined definitely. The lymphoid tissues and the bone-marrow are no doubt concerned in their formation. Like the red, so do the white corpuscles undergo disintegration in the organism, and the masses resulting from such disintegration are taken up by the spleen, which accounts for the enlargement of this organ in many acute infectious diseases. The quantity of blood corresponds to one-thirteenth of the entire body-weight.

Pathologic Physiology.—*Anemia* indicates a reduction in the amount of the blood, of its corpuscles, or of its constituent elements, such as hemoglobin and proteids. *Pseudo-anemia* refers to the pallor of the skin observed in patients with cardiac and renal disease, lead workers, and normal individuals who are naturally pale, in whom there is no reduction in the number of corpuscles nor hemoglobin. Anemia may be local or general. *Local anemia* may involve special parts or organs. The vasomotor nervous system in health regulates the amount of blood supplied to an organ in proportion to its needs. Thus, during digestion more blood is supplied to the digestive organs than at other times. Local anemia of the brain causes syncope, and a spasm of the arterial walls is observed in Raynaud's disease and in temporary aphasia and hemiplegia (page 378). *General anemia* may be: (1) secondary or symptomatic; (2) primary or essential.

Among the chief causes of *secondary anemia* are: (1) Anemia from hemorrhage; (2) from inanition; (3) from poisons; (4) from loss of albuminous material.

1. *Anemia from Hemorrhage.*—This may be traumatic or spontaneous. When the loss is in excess of about 50 per cent. of the total quantity of blood, the amount of blood left in the vessels is not sufficient to maintain the circulation, and the diminished arterial pressure causes the symptoms of acute asphyxia. A sudden profuse hemorrhage where the loss does not exceed 3 or 4 pounds of blood may be fatal. When the loss of blood is moderate, it is rapidly regenerated, as far as the fluid and saline constituents are concerned, by absorption from the gastro-intestinal tract. Months may elapse before the red corpuscles are restored to normal, and regeneration of hemoglobin occurs even later than the corpuscles. In the chronic anemias regeneration of blood does not occur so quickly, owing to the fact that the cause of the anemia persists.

2. *Anemia from Inanition.*—Any condition which interferes with the proper supply of food (cancer of the esophagus) or its preparation (chronic dyspepsia) provokes anemia in which the

plasma is more diminished than the corpuscles; in fact, the latter, owing to the reduction in the plasma, may be relatively increased.

3. *Toxic Anemia.*—It is well known that the blood-serum of one animal has the power of dissolving the red corpuscles of another species. The substances in the serum that are endowed with this property are known as hemolysins. In certain diseases toxic substances are developed in the body which possess the same property. Certain organic poisons (malaria and syphilis) and inorganic poisons (lead, mercury, arsenic, chloroform, and potassium chlorate) exercise a similar influence on the corpuscles, either directly or by augmenting their consumption. The life-period of a red blood-corpuscle has been estimated to be from three to four weeks. In fever the anemia is due to toxic substances, digestive disturbances, and interference with hematogenesis. Recently investigators have been occupied with the study of toxic anemia. It has long been known that substances of a toxic nature may be obtained from the organs, notably the pancreas, which break down the blood-corpuscles, and it is assumed that under pathologic conditions this hemolytic action may cause anemia. Such a substance has been obtained from the bothriocephalus latus, and in animals it causes anemia. Cholesterin was found to inhibit the lytic action of the cobra toxolecithid, hence its employment in anemias of supposed toxic genesis. Cholesterin, which is non-toxic, may also be valuable in parasitic anemias.

4. *Albuminorrhea.*—An excessive excretion of albumins occurs in Bright's disease, chronic suppuration, and prolonged lactation, and causes anemia. Here the anemia is characterized by poikilocytosis.

Primary or Essential Anemia.—(1) Chlorosis, (2) progressive pernicious anemia.

1. *Chlorosis.*—This form of anemia occurs almost exclusively in young girls at about the time of puberty (between the ages of fourteen and seventeen years). The etiology is obscure and the most frequent pathologic condition observed is a defective development (hypoplasia) of the circulatory and generative organs. The yellow-green tinge of the skin is characteristic in this disease, hence the popular designation "the green-sickness." The face, however, in exceptional instances may assume an unusually

brilliant color, a form known as chlorosis rubra. The subcutaneous fat is usually abundant and the face and ankles are puffy. Any symptoms, if present, are often secondary to the anemia. The characteristic changes of the blood are as follows: pale red blood-corpuscles and a great reduction in the amount of hemoglobin, without necessarily a reduction in the number of red or an increase of white corpuscles. The abundance of red cells and the impoverished hemoglobin (40 per cent. and lower) are pathognomonic of this disease. The specific action of iron in this disease (page 365) is also a characteristic feature.

2. *Progressive Pernicious or Idiopathic Anemia.*—According to Hunter, the two etiologic factors dominant in this disease are: hemolysis and chronic septic infection from oral, gastric, and intestinal sepsis. Middle-aged individuals are usually affected, although many cases are reported in children. Pregnancy and parturition, atrophy of the stomach mucosa, and parasites, notably the anchylostoma and the bothriocephalus, are further etiologic factors. The affection may develop in healthy subjects or it may be preceded by digestive or emotional disturbances. The disease begins slowly and the symptoms are not always progressive, as the name of the disease suggests; in fact, there are periods of gain and loss. The earliest symptom is languor, and later the least exertion causes dyspnea and faintness. The subcutaneous fat is retained despite the failing appetite. There is excessive facial pallor and the lemon-yellow tint of the skin suggests jaundice. When albumin is present in the urine, the latter sign plus the anemia, puffy face, and swollen ankles suggests Bright's disease, and the abnormal pigmentation, due usually to the administration of arsenic (page 50), may lead to the erroneous diagnosis of Addison's disease. The blood shows the following: red corpuscles are reduced to one-fifth or less in number (average 1,000,000), and the hemoglobin, while reduced (20 to 70 per cent.), is relatively increased. This relative increase of hemoglobin distinguishes the progressive from the secondary forms of anemia and chlorosis. Many nucleated red corpuscles are found, and they become increased in size (megalocytes), diminished in size (microcytes), or irregular (poikilocytes). The blood-plates are absent or scanty. The nervous symptoms of this form of anemia are characteristic

and they may develop even without symptoms. In other instances numbness and pain may be felt in the extremities (usually in the legs), and later a typical postero-lateral sclerosis develops. The sclerosis has been ascribed to anemia by some, and to toxic influences independent of the anemia by others. The pathology of the disease is obscure. There is always an increase of iron in the liver, due, as accurate observations show, to increased hemolysis, and the latter is probably caused, as Hunter suggests, by gastro-intestinal sepsis. The prognosis is usually bad, and Osler observes "that patients who do not take arsenic well usually do badly." In the forms in which a cause is discoverable, notably in the forms due to parasites, the prognosis is better (page 240).

Splenic Anemia (*Banti's Disease*).—Anemia is frequently associated with splenic enlargement (splenomegaly), notably in leukemia, Hodgkin's disease, and chronic malaria. Banti's disease forms a characteristic syndrome made up of cutaneous pigmentation, hemorrhages (especially gastric), and secondary cirrhosis of the liver which causes jaundice and ascites. In Gaucher's type of splenomegaly anemia is a prominent symptom. In this type the normal splenic parenchyma is replaced by large endothelial cells, and occasionally tumor-formations may exist.

Polycythemia.—In chronic venous stasis the capillary blood, owing to its concentration, contains more red corpuscles and hemoglobin than normal, and it is assumed that while this condition may exist in the peripheral circulation, it is not necessarily so with the blood in the rest of the body. Some explain this polycythemia by supposing that owing to deficient oxidation, the result of the stasis, an augmentation of red corpuscles occurs as a compensatory process. This theory, however, can rest on a firm foundation only when it has been shown that the polycythemia is universal. A residence in high altitudes causes an increase in the number of red corpuscles, and animals inhabiting these regions show a like increase. Here the polycythemia is probably caused by diminished atmospheric pressure, for if animals are exposed to low pressure under the air-pump, a like condition can be produced experimentally. In carbon-monoxid and phosphorus poisoning the red corpuscles are likewise increased in number. Now, in the conditions described polycythemia occurs without splenic enlargement, but in the disease known as *chronic polycythemia* the red corpuscles are enormously increased in number (8 to 13 millions per cubic millimeter), associated with chronic cyanosis and splenomegaly. The most frequent symptoms of the affection are headache, vertigo, and constipation.

Hemoglobinuria.—When hemoglobin escapes from the red corpuscles into the plasma, the condition is known as hemoglobinemia. When the quantity of hemoglobin set free is small in amount, it is removed from the plasma chiefly by the liver, and to a minor degree by the spleen and bone-marrow. It is known that the liver creates biliary pigments from hemoglobin. According to Ponfick, when the hemoglobin escaping from the corpuscles is equal to one-sixth of the total hemoglobin of the blood, it is excreted in the urine, and hemoglobinuria results. In the latter case blood-pigment and very few blood-cells are present in the urine. In toxic hemoglobinuria a number of drugs destroy the red corpuscles (page 93), and the same destruction is noted in many infectious diseases (malaria, syphilis, yellow fever, typhoid fever, etc.). In the epidemic hemoglobinuria of the newborn jaundice and cyanosis are associated symptoms. In paroxysmal hemoglobinuria an attack is precipitated by fatigue and exposure to cold. Predisposed individuals suffer an attack even when the hand is immersed in ice-water. During the intervals of the attacks the patient may be apparently well or there may be a trace of albumin in the urine. There is a close association between this affection and Raynaud's disease. Chills and fever may precede, and lumbar pain, vomiting, and diarrhea may attend, the attack. Two attacks may occur in a day, but, as a rule, the attack rarely persists for more than two days. The prognosis is usually good. Burns, if extensive, lead to a destruction of the red corpuscles and liberation of hemoglobin.

Leukocytosis.—This term, or hyperleukocytosis, signifies an increase in the number of white blood-corpuscles. By means of the triple stain, which will be described later, the following varieties of leukocytes are found in normal blood:

1. *Small lymphocytes*, which are smaller than a red corpuscle, with a single large nucleus which stains deeply and makes up the mass of the cell. Surrounding the nucleus is a narrow rim

of protoplasm without granules. These mononuclear cells are derived from the lymph-glands.

2. *Large lymphocytes*, which are also called large mononuclear leukocytes, are about two or three times the size of a red corpuscle, with a single nucleus, which is round or irregular, staining faintly, and situated eccentrically. The protoplasm surrounding the nucleus is free from granules. These cells are probably derived from the bone-marrow and are regarded as the parent types of the cells 3 and 4.

3. *Transitional cells*, which resemble the former, but the nucleus is constricted and shaped like a horseshoe, stains more easily, and is surrounded by protoplasm containing neutrophilic granules.

4. *Polymorphonuclear* (*or polynuclear*) *neutrophiles* are characterized by an irregularly shaped or bent nucleus which gives the impression that the cells contain more than one nucleus, hence the name polynuclear, which is a misnomer. The nuclei stain deeply and the protoplasm is filled with neutrophilic granules. This leukocytic variety forms the majority of pus-cells.

5. *Eosinophiles* are slightly smaller and more irregular in shape than the latter variety (4), and, like the latter, the nucleus is polymorphous, but stains more evenly but not so deeply. The granules of the protoplasm are stained a bright red, pink, or copper color by eosin. The eosinophiles are also called myelogenic leukocytes by those who believe that they originate from the bone-marrow.

6. *Mast cells* or basophilic leukocytes usually have a polymorphous nucleus and granulations, but do not take Ehrlich's triple stain. They have as yet no clinical value.

The following are the *pathologic leukocytes*, which are only found in pathologic conditions:

1. *Myelocytes* are large cells with a faintly staining nucleus, and differ from the large mononuclear cells of normal blood by the neutrophilic granules in the protoplasm; hence they are also known as mononuclear neutrophilic cells.

2. *Eosinophilic myelocytes* resemble the latter, but the granules are eosinophilic and not neutrophilic, *i. e.*, the granules assume

a bright red or copper color with Ehrlich's triple stain. Like the latter, they inhabit the bone-marrow.

Leukocytes in Health.—The number averages 7000 to the cubic millimeter (or 1 white to 700 red), but the physiologic limits vary from 5000 to 10,000 (or 1:1000 to 1:500). The percentage of the different varieties of leukocytes in normal blood is as follows:

Small lymphocytes	20 to 30%
Large lymphocytes	5 to 6%
Transition cells	1%
Polymorphonuclear neutrophiles	60 to 75%
Eosinophiles	2 to 4%
Mast cells	0.5%

Physiologic Leukocytosis.—This signifies a physiologic increase of leukocytes while the percentage of varieties is the same as in normal blood. Hyperleukocytosis is normal in the new-born infant (18,000) and in children (9000); in pregnancy (10,000 to 16,000), especially in the latter months; after exercise (11,000 to 13,000) and after cold baths (13,000) there is an increase of leukocytes in the peripheral blood. The leukocytes increase after a meal (an average of 10,000), especially when it is made up of a great amount of proteid material. This *digestion leukocytosis* occurs within three hours after a meal, and it is absent in gastric cancer, although the leukocyte-count may be high. In gastric ulcer the normal increase in the count occurs. All leukocyte counts must be made at a definite time each day, otherwise the results will be modified by the digestive hyperleukocytosis, and the same character of food must be ingested. The increase of leukocytes in the blood (leukocytosis) which can be effected by a meal or by the intravenous injection of pilocarpin or muscarin has been demonstrated by Dr. Henwood, of Toronto, to be of purely mechanic genesis, caused by contraction of the muscle-element in the spleen and lymph-glands.

Pathologic Leukocytosis.—This occurs in the following infectious diseases:

1. *Pneumonia:* The leukocytosis in this disease does not correspond to the severity of the infection, although in malignant pneumonia its absence is usually regarded as unfavorable. The leukocyte-count averages from 15,000 to 30,000, and a drop in the

count occurs either on the day of the crisis or on the preceding day. The neutrophiles are augmented in number and the eosinophiles disappear during the disease, and the reappearance of the eosinophiles indicates that the severity of infection is over.

2. *Acute articular rheumatism:* In uncomplicated cases there is a moderate polymorphonuclear neutrophilic leukocytosis (15,000), but it is increased when complications of the heart arise. The eosinophiles usually disappear, but reappear when the severity of infection is over.

3. *Meningitis:* In epidemic cerebrospinal meningitis polymorphonuclear neutrophilic leukocytosis is usual, and an absence of leukocytosis indicates a tuberculous form.

4. *Appendicitis:* According to Greenough, leukocytosis is usual in this disease; a count of 20,000 on the first or second day suggests general peritonitis; a count of 10,000 or less after the first week, if the symptoms are grave, indicates a general peritonitis and a catarrhal inflammation or well walled-off abscess if the symptoms are severe; after the first week or ten days a count of 20,000 suggests a local abscess. In nearly every case of appendicitis there is a diminution of hemoglobin (about 30 per cent.).

Suppurations.—When abscesses are encapsulated, the leukocyte count may be normal, but a progressive leukocytosis attaining a count of 30,000 to 40,000 or more indicates suppurative inflammation in affections of the pleura and biliary passages. The leukocytes may be normal even in the presence of purulent foci, because either no systemic reaction is provoked or because it is overpowered. Leukocytosis is also observed in erysipelas, scarlet fever, septicemia, pertussis, and mumps. There is ample reason to believe that leukocytosis is of decided advantage in infectious diseases as a protective measure against infection. According to the special variety of leukocytes which are increased, the following are differentiated:

1. *Polymorphonuclear Leukocytosis.*—This is the usual type of leukocytosis in which the polymorphonuclear neutrophiles predominate.

2. *Lymphocytosis.*—Here the lymphocytes predominate, and the increase may be *absolute* when the total leukocyte count is

above the normal, with a proportionate increase of lymphocytes, or *relative*, when the leukocyte count is normal or decreased, with an increased percentage of lymphocytes. Absolute lymphocytosis occurs in lymphatic leukemia and in sarcoma with metastases in the bone-marrow. Relative lymphocytosis occurs in healthy infants, in the diseases of early life, in pernicious anemia, in secondary syphilis, and in exophthalmic goiter.

3. *Eosinophilia.*—This signifies an increase in the percentage of eosinophiles, and is observed in trichinosis, cutaneous lesions, infections from internal parasites, and in bronchial asthma. In trichiniasis leukocytosis is always pronounced, but the characteristic feature is the increase in number of eosinophiles, which may represent more than 50 per cent. (normal 2 to 4 per cent.) of all the leukocytes. Eosinophilia is therefore a valuable symptom in this disease. In the diagnosis of bronchial asthma an examination of the blood and sputum for eosinophiles is of great value; eosinophiles may represent from 25 to 55 per cent. of all the leukocytes in the blood.

Referring to the value of the eosinophiles in the diagnosis of *typhoid fever*, Blumgart[303] formulates the following conclusions:

1. The entire disappearance or very marked diminution of the eosinophiles, together with a distinct leukopenia, goes far to establish the diagnosis of typhoid fever in doubtful cases.

2. A normal or increased percentage of eosinophiles, other things being equal, speaks against typhoid. This holds good, of course, only for the febrile course of the disease.

3. In cases of undoubted typhoid the presence of eosinophiles, even in small numbers, during the first week is a favorable sign and speaks for a probable mild type.

4. No typhoid fever patient should be considered cured or dismissed from observation before he has regained permanently, at least, a normal percentage of eosinophiles.

Eosinophilia may be produced by drugs like pilocarpin and potassium iodid.

Myelocytosis.—An increase in the number of myelocytes is characteristic of the spleno-medullary form of leukemia.

Leukopenia.—This is also known as hypoleukocytosis, and signifies a diminution in the number of leukocytes. Leukopenia occurs in the following diseases: Gastric cancer, typhoid fever, measles, epidemic influenza, miliary tuberculosis, tuberculous affections, malaria, progressive pernicious anemia, and in malnutrition and starvation. In making the differential diagnosis between gastric cancer and pernicious anemia the blood-changes are important. In the latter disease the red corpuscular count is one million or less, whereas in cancer it rarely goes below 2,000,000 per cubic millimeter, and in progressive anemia the high color-index of the blood is not present in gastric cancer. In typhoid the absence of leukocytosis is of great importance in distinguishing this from other diseases. Cold baths will increase temporarily the number of leukocytes in the peripheral circulation. Acute inflammatory processes in typhoid will also produce leukocytosis. Gennari[335] observes that leukopenia is more frequently encountered in the early stages of typhoid fever than any other sign (including Widal's test). Thus, out of sixty-six cases forty-seven had less than 5000 white corpuscles per cubic millimeter. If leukocytosis is present, it is caused by some complication.

Leukemia.—This signifies a persistent increase in the number of leukocytes in association with changes in the spleen, lymphatic glands, or bone-marrow. Different forms of leukemia are described, based on changes in the hematogenic organs and the varieties of cells in the blood. The two main types of the disease are: (1) *Spleno-medullary leukemia*, in which the changes are located in the spleen and the bone-marrow, and (2) *lymphatic leukemia*, in which the changes are localized in the lymphatic apparatus. The etiology of the disease is unknown, and males in the middle period of life are more often affected than females. A malarial history may be obtained in a small percentage of cases. Spleno-medullary leukemia is the more frequent of the two forms, and splenic enlargement with tenderness on pressure is invariable. Dyspnea on exertion and hemorrhages are frequent symptoms. The leukocytes show an enormous increase and in some instances may exceed the red corpuscles in number. The average ratio of the white to the red cells is 1 to 10. The *myelocytes* derived from the bone-marrow constitute about 30 per cent. of the leukocytes, and this is one of the most characteristic changes in the blood in this variety of the disease. The number of red cells is diminished, but the count is rarely below 2,000,000 per cubic millimeter. The blood in leukemia clots more quickly than normal, and owing to the predominance of leukocytes, the coagulum has a pus-like color. Another feature in this variety of leukemia is the hyperplasia of the red bone-marrow, which often leads to the formation of nodular tumors, especially in flat bones like the sternum and ribs, which are sensitive to the touch. Even in the absence of such tumors the bones are sensitive on percussion. In the *lymphatic* form, also called acute leukemia, because it develops acutely and may terminate fatally within a few months, the subjects are younger. There is a general lymphatic enlargement, including the lymph-glands, tonsils, and the lymph-follicles of the pharynx, tongue, and mouth.

Leukemic tumors may form in the organs from leukocytes which have escaped from the capillaries. The liver and spleen are enlarged in consequence of the proliferation of the lymphoid cells *in situ* and the accumulation of leukocytes.

In lymphatic leukemia the hyperplastic proliferation is localized in the lymph-glands and not the bone-marrow, hence myelocytes are absent, and instead the lymphocytes are increased in number and may constitute 95 per cent. or more of all leukocytes. In leukemia the *x*-rays applied to the spleen, spine, and joints (where red marrow is most abundant) often give a decided reaction. The white cells are first augmented and there is pyrexia, but there soon follows a decided fall in the number of leukocytes with an increase of red cells. The other symptoms of the disease abate, but relapses are not uncommon.

Leukanemia.—By this term Leube described an affection characterized by a combination of leukemia and severe anemia with symptoms of acute infection. The affection may begin suddenly with acute tonsillitis, and the prominent symptoms are exhaustion, hemorrhages, extreme pallor, enlargement of the liver and spleen, and the disease may terminate fatally in a few days or after several months. The hemal signs are characteristic of pernicious anemia and leukemia, viz., a rapid diminution in the number of red cells and hemoglobin and an increase of leukocytes (usually lymphocytes).

Aleukemic Leukemia.—Blumer[194] has shown that there are severe grades of anemia with even a diminution in the number of leukocytes in the blood, but which show at the autopsy all the pathologic features of lymphatic leukemia, hence such forms without leukemic blood changes are called aleukemic. It is well known that in leukemia transient improvement may occur spontaneously, and that the number of leukocytes may be reduced in the course of many infectious diseases (notably influenza, pneumonia, typhoid) and after the use of arsenic, quinin, tuberculin, nuclein, and the *x*-rays.

Pseudo-leukemia.—This affection, characterized by a continuous enlargement of the lymphatic glands and spleen, with a secondary anemia (usually slight), with or without an increase in the number of leukocytes and lymphoid growths in various organs, has been described by the following designations: Hodgkin's disease, lymphatic anemia, and generalized lymphadenoma. Some consider this disease to be of infectious origin, others regard it as a peculiar form of tuberculosis. In a few cases tubercle bacilli are found, but in the majority of cases they are absent in the glands and the tuberculin test in the classic forms of the disease is negative. The present view regards tuberculosis as an accidental or terminal infection. In the commencement of the disease the blood may be normal, but later the red cells and hemoglobin are reduced. In the diagnosis of this affection the following diseases must be excluded: tuberculosis, leukemia, and lymphosarcoma. Tuberculosis may be excluded by a histologic study of an extirpated gland and by the *tuberculin test* in afebrile cases. In tuberculosis of the glands the latter test is positive. In the later stages of pseudo-leukemia, when cachexia is present and many glands are involved, tuberculin may yield a positive reaction. In pseudo-leukemia, in the earlier stages, the glands are isolated and easily movable, but later they coalesce. Even in early tuberculous adenitis the glands adhere to the skin, become coalescent, and suppurate. Leukemia can at once be excluded by the hemal signs. To exclude lymphosarcoma, a microscopic examination of an excised gland may be necessary. The histologic picture of glands in pseudo-leukemia is characteristic, according to Reed: (1) There is a proliferation of the endothelial and reticular cells; (2) the formation of lymphoid cells uniform in size and shape; (3) the formation of giant cells from proliferating endothelial cells; (4) proliferation of the connective tissue; and (5) the large number of eosinophile cells which characterize the majority of cases.

Tests for Hemal Sufficiency.

Quantity.—As already shown (page 416), it is reasonable to assume that the total quantity of blood in the body may be increased (plethora) or diminished, yet it is practically impossible to demonstrate such conditions.

Hydremic plethora refers to an increased quantity of blood dependent on the retention of water, and is present in cardiac and renal diseases. This edema of the blood is characterized by a fall in the percentage of hemoglobin, for the latter pigment cannot enter and leave the blood as quickly as the soluble ingredients of the blood. It is evident that the reduced hemoglobin percentage is of value only when it develops acutely (the previous percentage being known to the physician), and when all the conditions leading to anemia can be excluded. In plethoric conditions the hemoglobin percentage is usually increased even up to 120 per cent.

Coagulation.—*Vide* page 151.

Hemoglobin.—No hemanalysis is complete without estimating the percentage of hemoglobin. In all anemias there is a diminished percentage of this pigment, and the condition is known as *oligochromemia.*

Pallor of the skin is no indication of anemia, insomuch as it may be caused by diminished cutaneous transparency or by anemia of the skin.

The supply of oxygen to the tissues is influenced by the percentage of hemoglobin, and it has been shown that in acute hemorrhage death occurs when about 70 per cent. of the total quantity of hemoglobin is lost.

In the differentiation of concealed hemorrhage from shock, one must remember that in the former condition the hemoglobin is enormously reduced, whereas in shock it is unaltered. In discussing pulmonary anemia (page 363) it was remarked that the amount of iron in the blood was probably normal in amount, and that the element missing was oxyhemoglobin. There are a number of instruments used for estimating the hemoglobin percentage, known as hemoglobinometers, the best known of which are Gowers', Oliver's, and Dare's. Others are known as hemometers, and such are von Fleischl's and Sahli's. They are all based on the simple principle of colorimetry, that of comparing a solution of the blood with an artificially colored substance. Thus, in the well-known instrument of von Fleischl the standard of comparison is a colored wedge of glass, and by means of a scale graduated from 0 to 120, the hemoglobin percentage may be determined. The most accurate method for estimating the amount of hemoglobin is the hematospectrophotometer, but it is too expensive and complicated for practical use. There are two simple and yet sufficiently accurate methods for determining the percentage of hemoglobin, viz., the specific gravity method and the Talqvist method.

Specific Gravity.—The specific gravity of the blood corresponds to the percentage of hemoglobin, except in dropsical cases, in which the composition of the blood-plasma varies. The following are necessary: an accurate urinometer (clean and dry), a medicine-dropper, a glass rod, a bottle of chloroform, which is lighter, and a bottle of benzol, which is heavier, than blood. The urinometer is placed in a suitable tube, and into the latter chloroform and benzol are alternately poured until the urinometer registers the specific gravity of normal blood (1.059). After removing the urinometer, puncture the ear or finger of the patient and take up the flowing blood with the medicine-dropper. From the latter, which must be free from air-bubbles, expel one or two drops of blood into the chloroform-benzol mixture. If the floating red globule rises to the top, add a few drops of benzol and stir the mixture with the rod, and if it sinks add chloroform. Eventually, by adding the two fluids alternately, the globule neither rises nor falls, but floats midway between the top and bottom, and the specific gravity of the suspended blood globule will be equal to that of the fluid, which is now determined by the urinometer. The fluid may be used any number of times, if after each estimation the blood is separated by filtration.

This method of Hammerschlag shows the following:

SPECIFIC GRAVITY.	HEMOGLOBIN.
1033–1035	25–30 per cent.
1035–1038	30–35 “
1038–1040	35–40 “
1040–1045	40–45 “
1045–1048	45–55 “
1048–1050	55–65 “
1050–1053	65–70 “
1053–1055	70–75 “
1055–1057	75–85 “
1057–1060	85–95 “

Talqvist's Method.—This a simple method, designed for the practitioner, with a possible error of only 5 to 10 per cent., for ascertaining the hemoglobin percentage. A little, inexpensive book is sold containing sheets of bibulous paper. A piece of the paper is brought in contact with a drop of blood, and after the gloss of moisture disappears the tint of the blood-stain is compared in daylight with a lithographed color-scale representing various percentages of hemoglobin.

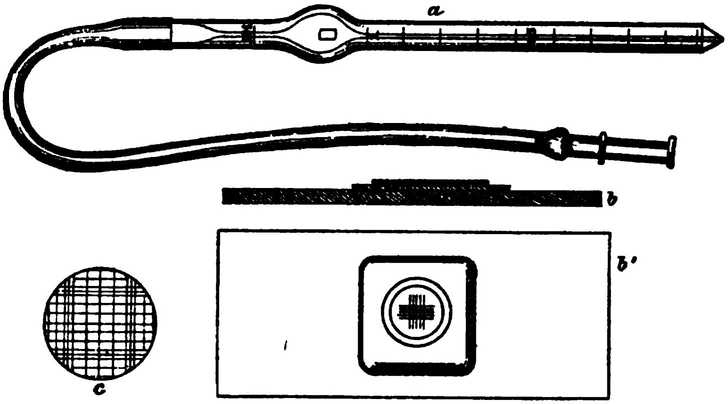

Fig. 142.—Thoma-Zeiss hemocytometer. *a*, Mixing pipet for the red cells (there is also one for the white cells); *b*, blood-counting slide (elevation); *b'*, counting slide (plan); *c*, counting chamber.

Counting the Red (Erythrocytes) and White Cells.—The hemocytometer of Thoma-Zeiss is commonly used for this purpose, and consists of two mixing pipets (for the red and white cells) and a counting slide (Fig. 142). Counting is facilitated by Toisson's solution, which enables one to distinguish the white (stained violet) from the red cells. The solution in question for diluting the blood is as follows:

Methyl violet, 5 B	0.025	gram
Sodium chlorid	1	"
Sodium sulphate	8	grams
Neutral glycerin	30	"
Distilled water	160	"

Simon's method[195] simplifies the process of blood-counting. The counting slide is made by E. Leitz & Co. The description and use, according to Simon, are as follows: The instrument, as placed on the market, consists of the two ordinary diluting pipets and the counting chamber. The latter (Fig. 143) is ruled into 100 large squares (*A*, *A*, *A*), each occupying an area of 0.04 sq. mm. They are separated from one another by double guiding lines (*ab*, *ab*), with an intervening distance of 0.05 mm. Where the horizontal and vertical lines intersect, small squares (*a*, *a*, *a*) result, 100 in number, which accordingly have an area of 0.0025 sq. mm. each. The large squares are thus bounded by rectangles (*b*, *b*), measuring 0.05 mm. in width by 0.02 mm. in length, representing an area of 0.01 sq. mm. As the little platform (*P*) carrying the ruling is exactly 0.01 mm. lower than the outside glass plate (*D*), each large square represents the base of a cube, the contents of which are 0.04 × 0.01 = 0.004 cb. mm.; each small square similarly corresponds to 0.00025 × 0.01 = 0.000025 cb. mm.; and each rectangle to 0.001 × 0.001 = 0.0001 cb. mm.

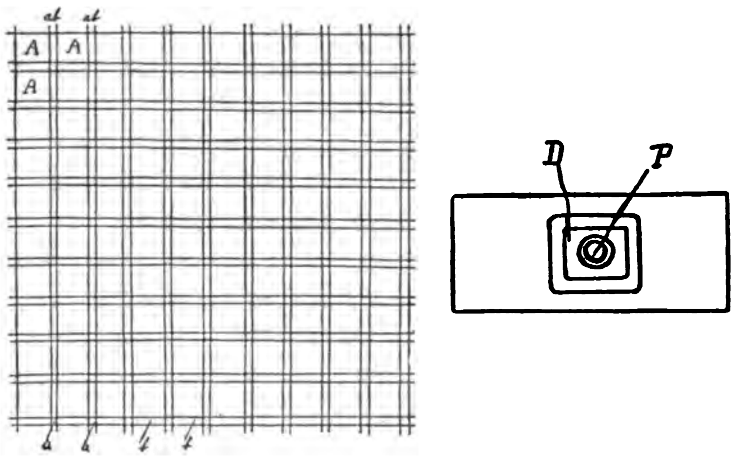

Fig. 143.—Counting chamber and slide employed in Simon's method for the enumeration of the blood-corpuscles.

Method.—1. Enumeration of Leukocytes: A drop of blood, diluted in the 1 : 10 pipet, with a 1 per cent. solution of glacial acetic acid, containing a small amount of gentian-violet, is mounted in the usual manner and placed under the microscope. Starting with the top row of large squares at the left corner, the total number of leukocytes in the 100 large squares is carefully counted. This number, divided by 100, gives the average number of leukocytes for one large square. As the cubic contents of each large square are 0.004 cb. mm., it is only necessary to multiply the number of leukocytes in one square by 250 in order to find the number in 1 cb. mm. of diluted blood, and thus, by the degree of dilution, to find the number for 1 cb. mm. of non-diluted blood.

Example: Total number of leukocytes counted in the 100 large squares = 400; hence 4 = number for one large square, *i. e.*, for 0.004 cb. mm. of diluted blood; 250 × 4 = 1000 is hence the number in 1 cb. mm. of diluted blood, and 1000 × 10 = the number in 1 cb. mm. of non-diluted blood.

2. Enumeration of Red Cells: The blood is diluted with Toisson's solution or a similar diluent in the 1 : 100 pipet, and a drop mounted as usual. All the red cells are then counted, in the 100 small squares if no marked degree of anemia exists, or in the 40 rectangles if there is evidence of a distinct oligocythemia. The calculation is made as follows, bearing in mind the cubic contents corresponding to the small squares and the rectangles, viz., 0.00025 and 0.001 cb. mm. respectively.

Example: Number of red cells in 100 small squares equals 1000; in one, therefore, 10, viz., in 0.00025 cb. mm.; in 1 cb. mm. of diluted blood 4000 × 10 = 40,000, and in 1 cb. mm. of non-diluted blood 40,000 × 100 = 4,000,000.

Example 2: Number of red cells in 40 rectangles equals 800; in one rectangle therefore 20, *i. e.*, in 0.001 cb. mm.; in 1 cb. mm. of diluted blood, hence 20 × 1000 = 20,000, and in 1 cb. mm. of non-diluted blood 20,000 × 100 = 2,000,000.

If for any reason a larger area is to be counted for red cells, this can, of course, be readily done by going over a larger number of rectangles, or by combining small squares and rectangles, due allowance being made, of course, for the cubic contents of the ground covered.

Loewenberg's Method.—The blood is diluted 1 : 400 and a drop is placed on a round object-glass and pressed with a cover-glass. The number of corpuscles in a field is counted. As two circles are proportional to each other according to the squares of their radii, the total number of corpuscles on the object-glass may be computed by this formula. The radius of Loewenberg's microscopic field is 0.5 mm. and of his object-glass 10 mm.; the object-glass thus represents 2500 of the microscope fields, and if 25 corpuscles are counted in one field, it is easy to compute the number in a cubic centimeter. If, for example, 5 cb. mm. of blood diluted to 400 were used, then 2500 multiplied by 400 and divided by 5, and then multiplied by the number of corpuscles observed in the microscope field, would give the correct number of corpuscles in a single cubic millimeter. The dilution to 400 is made by mixing 10 cb. mm. of blood with 4 c.c. of a 3 per cent. salt solution.

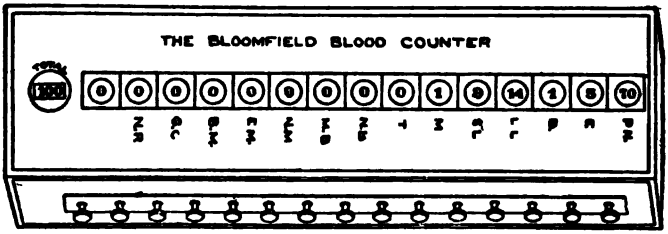

Fig. 144.—The Bloomfield blood-counter.

Bloomfield[275] suggests the use of the *hematometer*, which counts the red and white blood-corpuscles, also their different varieties, giving below the sum total of the reds and whites respectively. It is a simple mechanism, consisting of a set of discs which are numbered consecutively to the highest average number of each particular variety (Fig. 144). As soon as the total comes to 100 the bell rings, and the differential count can be read right off. For convenience, the slip containing the classification can be easily changed, if desired, to correspond with the one usually followed by the examiner. The instrument made by Tiemann is 8 inches in length and weighs about 9 ounces; is absolutely accurate, portable, and durable, and requires no skill nor technic in its use. As each number is turned up a click is heard, and the decided inconvenience of withdrawing the eye from the microscope to jot down the figure, or the necessity of having an assistant to mark down the figures, is overcome.

Hematocrit.—This instrument was designed to supplant the tedious method of blood-counting, but it is not an accurate method for ascertaining the number of cells. By this method the blood is centrifuged for five minutes, at the end of which time the erythrocytes form a red layer at the bottom of the capillary tube and a white layer of leukocytes above.

Number of Red Cells.—In 1 cb. mm. of blood in man there are 5,000,000 and in women 4,500,000 erythrocytes. A physiologic increase is noted after fasting, after the use of cathartics and diuretics (removal of water from the blood), after a cold bath, and residence in high altitudes. The hemoglobin is correspondingly increased. A physiologic decrease in the number of erythrocytes occurs after eating and drinking (dilution of the blood), and obese subjects show a lower red blood-cell count than thin individuals. The ratio of the red to the white varies from 1:300 to 1:700. A pathologic increase of erythrocytes is known as polycythemia and a decrease as oligocythemia. The condition known as polycythemia has already been described (page 884). The average count in ordinary anemia is from 3 to 4 millions, whereas in the pernicious form (page 883) the count may show only 143,000 to the cubic millimeter, as in the case reported by Quincke.

Color-Index.—By expressing the blood-count of the erythrocytes and the hemoglobin-estimation in percentages of the normal, and dividing the percentage of hemoglobin by the percentage of the number of erythrocytes, the result will indicate the amount of hemoglobin in a blood-cell as compared with the normal amount. This fraction is called the color-index, which in the norm is equal to 1. Thus if the percentage of hemoglobin is 45 and the number of erythrocytes is 2,000,000, or 40 per cent. of the normal, the calculation would be $\frac{45}{40} = 1.1 +$ the color-index (C.I.). This plus C.I. is characteristic of pernicious anemia, whereas a minus C.I. is characteristic of chlorosis. At birth and in some adults the hemoglobin percentage is over 100, whereas a percentage of even 90 in adults may be considered normal. In a large number of the anemias the hemoglobin is more reduced than the number of the erythrocytes. If the hemoglobin increases or diminishes in proportion to the number of erythrocytes, the C.I. always remains 1. Thus 50 per cent. of cells with 50 per cent. of hemoglobin equals $\frac{50}{50} = 1$.

Microscopic Examination.—Respecting the technic, the reader is referred to the numerous works on hematology.

With Ehrlich's triple stain the neutrophilic granules are most distinctly stained: the hemoglobin is orange-colored, the nuclei green, the neutrophilic granules violet, the eosinophilic granules copper-colored, and the basophilic granules are indistinctly stained.

Blood-Test for Diabetes.—(*Vide* page 247.)

Iodin Reaction.—It is claimed that if acute suppuration occurs in the organism, the protoplasm of the white cells will be stained (brown) diffusely or as a network by means of iodin, and if suppuration is not in progress, the red cells stain a dark yellow and the white cells a light and their nuclei a citron yellow. The pathologic reaction indicating suppuration applies to the appearance of brown-stained granules in the polynuclear neutrophiles. The technic most recently recommended is that of Ehrlich: after the specimen is dried in the air, it is placed under a closed glass containing crystals of iodin for several minutes at least, until the color is dark brown, when it is mounted in a drop of saturated levulose and examined microscopically. Bernicot,[248] who has recently studied the iodin-reaction of the leukocytes, believes that it is so inconstant and variable that it cannot be considered trustworthy as a routine procedure. He considers it of great value in lobar pneumonia, in which its persistence after the crisis signifies complication or delayed resolution, and in suspected abscess, in which its absence is of great negative value.

Sudanophilia.—In 1906, M. Cesaris-Demel described the presence of minute drops of some fatty substances in the protoplasm of leukocytes in the circulating blood, which fat reacted best to a staining mixture of Sudan III and brilliant creyl blue. The presence of this fat was supposed to be indicative of suppuration in some portion of the body. Many observers have recently confirmed the foregoing observation, notably Marchis, who regards such leukocytes as developmental pus-corpuscles.

Malarial Plasmodia.—Demonstration of the plasmodium malariæ is a difficult matter for the inexperienced, and even expert microscopists have sought for them in vain in undoubted cases of malaria. A single plasmodium suffices for the diagnosis of malaria, although the number of plasmodia found is usually in proportion to the severity of the disease. The blood should be examined during and between the attacks. Among the causes of failure to demonstrate the plasmodia are: (1) Using too thick a layer of blood. (2) A hasty examination (a negative result should only be admitted after a search for at least thirty minutes). (3) Examination of the blood at an improper time (the most propitious time is about ten hours before or after a chill, when the plasmodia are present in large numbers in the peripheral blood). (4) When quinin has been given, insomuch as this drug produces a necrosis of the parasite. The crescents are immune to the action of quinin, but the plasmodia developing from them are destroyed.

For rapid staining Koch's method may be used: After passing the dry specimen once through a flame, it is placed in alcohol for twenty minutes, dried, and then dipped into the following solution several times: An aqueous 2 per cent. solution of methylene-blue and 5 per cent. of borax. The latter solution before use is diluted with water until a layer 1 cm. thick begins to become transparent. After staining, the specimen is washed with water until it has become slightly greenish in color. It is then dried and mounted in cedar oil. The plasmodia are stained an intense blue, blood-corpuscles pale green, and the nuclei of the leukocytes darker than the plasmodia.*

Lipemia.—In the norm fat is found in the blood especially during digestion. If the amount is abnormal, as in chronic alcoholism, diabetes, acute phosphorus-poisoning, and in fractures (which may form fat-emboli), the cloudiness and pallor of the blood may be evident macroscopically. Microscopically, fine granules or refracting drops may be observed, which are stained black by osmic acid and red by Sudan III. Ether will dissolve the fat in a dry specimen.

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* Rosenberger (Amer. Jour. Med. Sci., Feb., 1909) finds tubercle bacilli in the circulating blood in every case (125 examined) of *tuberculosis* (incipient and healed cases included) according to the following technic: Withdraw 5 c.c. of blood from a vein of the arm and place it immediately in an equal quantity of a 2 per cent. solution of sodium citrate in normal soda solution. Shake mixture and permit it to stand in a refrigerator for twenty-four hours. Pipette sediment and make a thick slide-preparation and dry upon a copper plate with moderate heat, and then place in distilled water until complete laking of blood occurs. Next dry slide in a Bunsen flame and stain in the usual way for tubercle bacilli. No negative result is to be recorded until thirty minutes is given to the examination of a slide.

Hemoglobinemia.—When normal blood is allowed to coagulate, the serum has a yellowish tinge, but in hemoglobinuria the hemoglobin is in solution, hence the serum will be of a ruby red or brown (if methemoglobin is present). Unless the serum is free from cloudiness, the blood-corpuscles may color the serum, hence this test is of value only when the serum is absolutely clear.

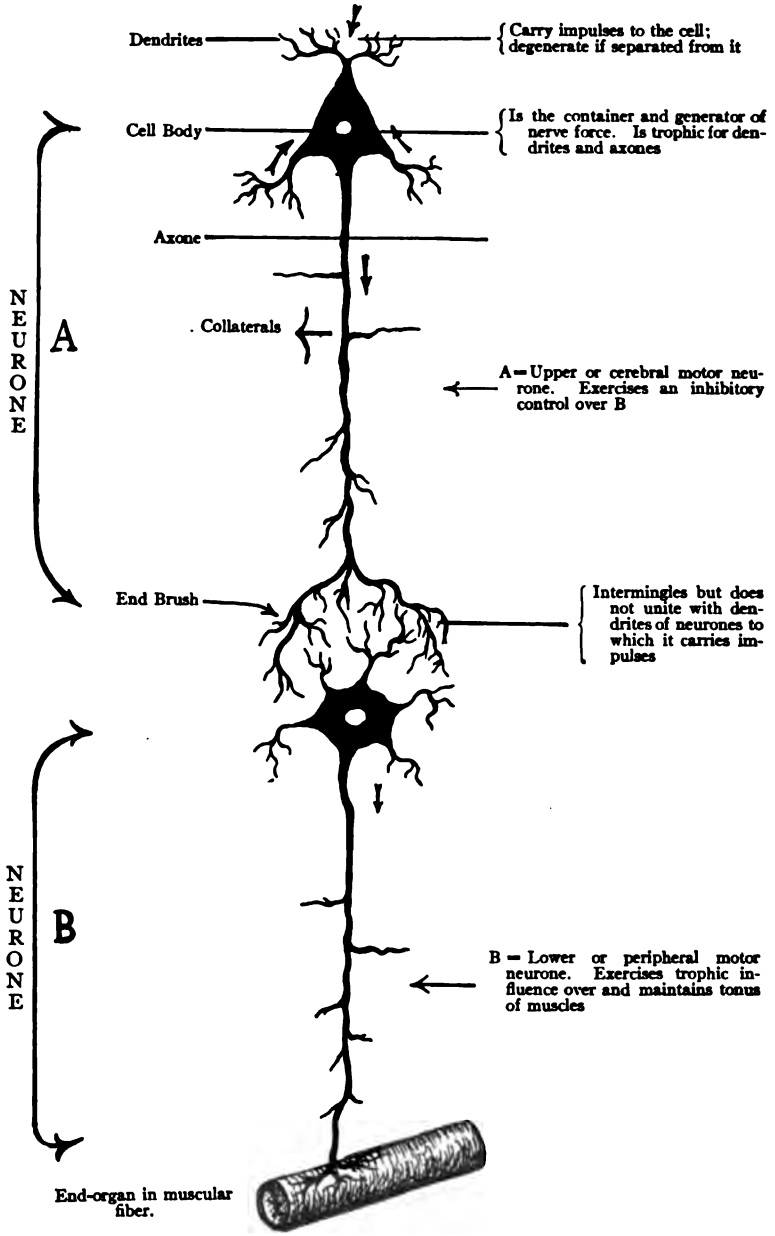
Icterus.—The earliest symptom of jaundice is icteric coloration of the blood-serum. Again, it is important to know whether a persistent coloration of the skin is merely due to the deposit of pigment in the skin or to circulating biliary pigments. These questions may be solved, according to Hamel, by allowing about 20 drops of blood from a puncture to enter a capillary tube, and then closing the two ends with wax; in a few hours the color of the serum may be noted after it separates from the clot.

Plumbism.—It is a difficult matter to demonstrate the presence of lead in the urine even though the patient is suffering from pronounced symptoms of plumbism, but attention has been called by Grawitz[230] to a granular degeneration of the red blood-cells as one of the earliest and most trustworthy signs of this condition. It consists in the presence, in certain of the red blood-corpuscles, of minute particles having a strong affinity for basophilic dyes, so that in a blood-preparation stained with one of the methylene-blue solutions the cells in question present varying numbers of minute bluish points. The other conditions in which it is likely to occur, such as cancer, pernicious anemia, intestinal putrefaction, and sepsis, can usually be excluded without difficulty, but the possibility of their occurrence must be kept in mind. The value of routine blood examinations with this appearance in view is very great, as in this way individuals may be excluded from the more dangerous forms of work until the disappearance of the basophilic granulation indicates that for the time being the danger of lead poisoning is over. As the granules in the red cells usually appear before the other symptoms have become characteristic, if the blood of those engaged in occupations that involve danger of plumbism is watched carefully, the severer forms of intoxication can very often be forestalled. There is also another and very useful application of this discovery, in that by frequent blood-examinations one may very accurately estimate the degree of success of any therapeutic measures that may have been instituted.

THE NERVOUS SYSTEM.

Anatomic and Physiologic.—The modern conception of the nervous system conceives it to consist of an enormous number of units, called *neurones*, and each neurone consists of a cell body, dendrites, and an axone (Fig. 145). In the neuronic architecture of the nervous system the neurones are in closely packed groups intimately connected with each other, but never directly. Each neurone with its axones and dendrites is anatomically independent, and the latter do not anastomose with another neurone. The neuronic mass receives impressions from within and without the body and sends forth other impulses which regulate the functions and establish a harmonious relationship between man and his environment. The division of the neurones into central and peripheral and their functions are fully demonstrated in the excellent schema of Butler (Fig. 145).

Brain and Spinal Cord.—The cerebral cortex, *i. e.*, the gray matter upon the surface of the brain, is the seat of mental activity. It has ridges (gyri or convolutions) and depressions (sulci or fissures). The psycho-motor region of the cortex (motor area) comprises the anterior and posterior convolutions and the lobus paracentralis of either hemisphere (Fig. 146). The motor area does not extend beyond the fissure of Rolando, hence it is often known as the Rolandic area. Stimulation of the motor areas produces movement of some part of the opposite side of the body, and excitation of the same part is always followed by the same movement. Thus it has been possible to locate the motor areas in the brain (Fig. 147). The cortex may be mapped out into *sensory* areas, which are also shown in the illustrations (Figs. 146, 147). Such areas concern muscle-memories, hearing and memories of spoken language (first and second temporal convolutions), word-vision and memories of written words (angular and inferior parietal convolutions), and visual sensations.



Carry impulses to the cell; degenerate if separated from it

Is the container and generator of nerve force. Is trophic for dendrites and axones

A = Upper or cerebral motor neurone. Exercises an inhibitory control over B

Intermingles but does not unite with dendrites of neurones to which it carries impulses

B = Lower or peripheral motor neurone. Exercises trophic influence over and maintains tonus of muscles

Fig. 145.—The neurone (diagrammatic).

Pyramidal Tract.—From the cortical centers the motor fibers converge toward the large ganglia at the base of the brain, where they present a white strand of fibers (internal capsule). From the capsule the fibers pass into the pons and then into the medulla, where they form the pyramidal bodies. At the lower part of the medulla about 10 per cent. of the fibers pass down the same side of the spinal cord in the anterior pyramidal tracts, whereas the other fibers (crossed fibers) pass to the opposite side of the cord into the lateral pyramidal columns. From these columns the fibers pass into the ganglionic cells of the anterior horns, and from these cells the anterior roots of the spinal cord are formed which send motor fibers to the muscles. The centers of the cerebral cortex control the nutrition of the pyramidal tracts up to the point where they enter the ganglia of the anterior horns of the cord, whereas the latter control the nutrition of the peripheral motor nerves and muscles. The motor path is shown in the illustration (Fig. 148) after Butler.

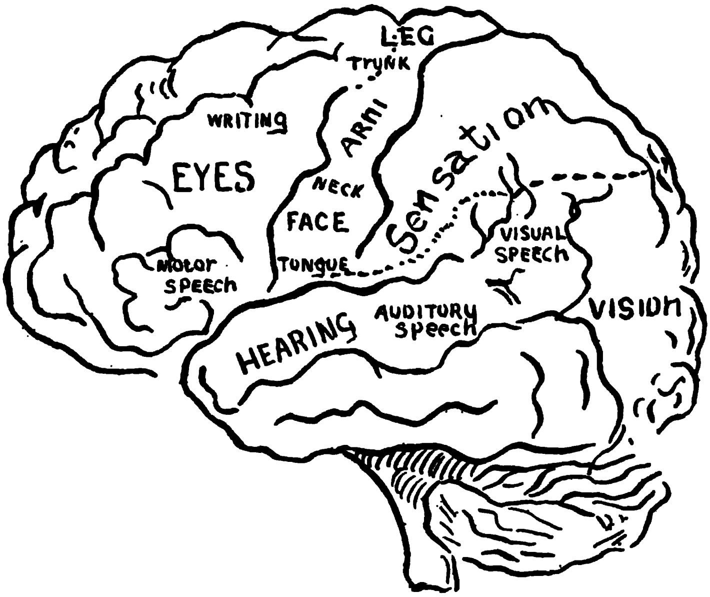


Fig. 146.—Cortical localization in the left hemisphere. The motor areas have been determined by unipolar excitation of the anthropoid cortex and are situated anterior to the fissure of Rolando, whereas posterior to the latter fissure is the probable situation of the sensory areas.

Sensory Path.—The path for sensory is more complicated than that for motor conduction. The direct sensory path (for touch, pain, and temperature) runs from the posterior sensory root of the cord across the latter to the antero-lateral column to the cortex, whereas the indirect sensory paths (for co-ordinative sensations from muscles, joints, and viscera) run upward on the same side through the cerebellar tract and the posterior column, and at the upper part of the cord they decussate to the cortex. The sensory areas of the cortex have not been definitely established, but they are supposed to reside posterior to the motor areas in the parietal lobe and in the posterior central convolutions (Fig. 147). The location of the motor and sensory paths is shown in the illustrations (Figs. 148, 149).

PATHOLOGIC PHYSIOLOGY.

The Blood-vessels.—The brain is supplied with four large arteries which anastomose to form the circle of Willis (Fig. 150). The brain must always be supplied with blood, for otherwise there would be loss of consciousness due to cerebral anemia. In dogs all the brain arteries may be tied without producing serious symptoms, insomuch as enough blood reaches the brain by branches from the superior intercostal arteries to the anterior spinal artery. In man, however, the sudden obliteration of one carotid artery may provoke epileptiform spasms, and loss of consciousness, when both carotids are suddenly occluded. The cerebral functions are dependent on the proper supply of oxygen as well as the quantity of blood. The blood from the brain is collected by the veins and discharged into the cerebral sinuses (Fig. 151). In the norm the quantity of blood in the brain is practically constant, and any increase or decrease in the quantity is dependent on the amount of cerebrospinal fluid which is transferred to and fro from the cranial and spinal cavities. Although the variations in the quantity of blood may be slight, changes in the velocity of the current occur and the relation between arterial and venous blood is modified. Physiologists have failed to demonstrate that the cerebral vessels are under vasomotor control, and it is assumed that the circulation in the brain adapts itself to the conditions prevailing in the general circulation; hence, if the aortic pressure rises and the vena cava pressure is constant,

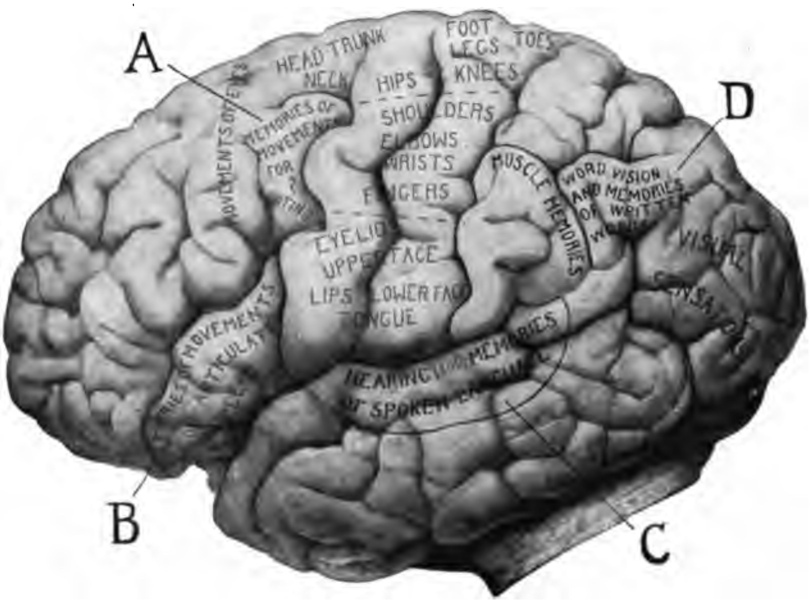

A
HEAD TRUNK
NECK
FOOT
LEGS
TOES
KNEES
HIPS
SHOULDERS
ELBOWS
WRISTS
FINGERS
MOVEMENTS OF EYES
MEMORIES OF MOVEMENTS FOR ? WRITING
EYELID
UPPER FACE
LIPS
LOWER FACE
TONGUE
MUSCLE MEMORIES
WORD VISION AND MEMORIES OF WRITTEN WORDS
D
VISUAL
SENSATION
MEMORIES OF MOVEMENTS OF ARTICULATION
HEARING AND MEMORIES OF SPOKEN LANGUAGE
B
C

Fig. 147.—The localization, of the principal motor and sensory functions of the brain upon the outer surface of the left hemisphere. The motor areas are in large, and the sensory areas in small type. (From Butler, with kind permission of D. Appleton & Co., New York.)

PLATE XVIII.

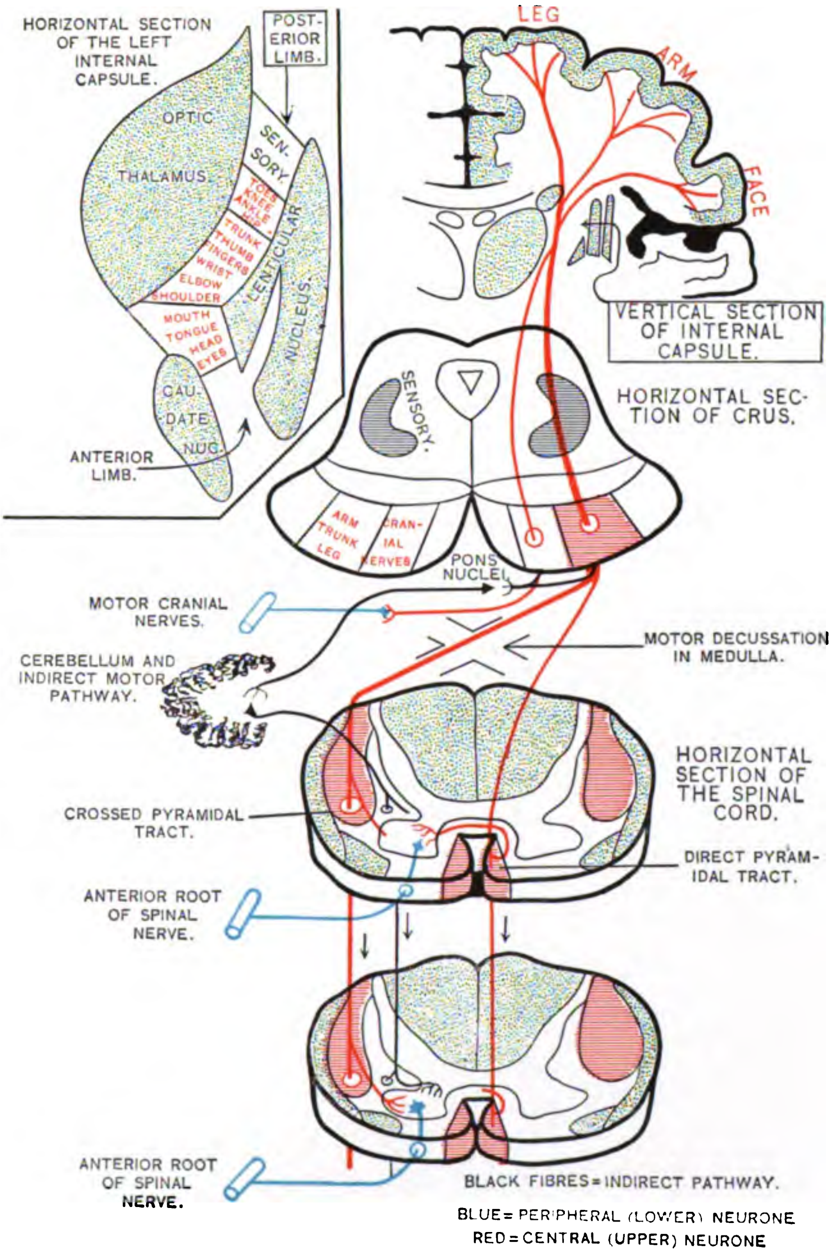

HORIZONTAL SECTION OF THE LEFT INTERNAL CAPSULE.
POSTERIOR LIMB.
OPTIC
THALAMUS.
SENSORY.
TOES
KNEE
ANKLE
HIP
TRUNK
THUMB
FINGERS
WRIST
ELBOW
SHOULDER
MOUTH
TONGUE
HEAD
EYES
LENTICULAR
NUCLEUS.
CAUDATE NUC.
ANTERIOR LIMB.
LEG
ARM
FACE
VERTICAL SECTION OF INTERNAL CAPSULE.
SENSORY.
HORIZONTAL SECTION OF CRUS.
ARM
TRUNK
LEG
CRANIAL NERVES
PONS NUCLEI
MOTOR CRANIAL NERVES.
MOTOR DECUSSATION IN MEDULLA.
CEREBELLUM AND INDIRECT MOTOR PATHWAY.
HORIZONTAL SECTION OF THE SPINAL CORD.
CROSSED PYRAMIDAL TRACT.
DIRECT PYRAMIDAL TRACT.
ANTERIOR ROOT OF SPINAL NERVE.
ANTERIOR ROOT OF SPINAL NERVE.
BLACK FIBRES = INDIRECT PATHWAY.
BLUE = PERIPHERAL (LOWER) NEURONE
RED = CENTRAL (UPPER) NEURONE

Fig. 148.—Motor pathways. ***Direct motor path*** (for voluntary impulses) runs from cortex, via corona radiata, internal capsule, crus, pons, medulla, crossed and direct pyramidal columns, to motor cells of anterior horn; the cranial nerve motor fibers cross at various levels in crus, pons, and medulla. The ***indirect motor path*** (for muscular co-ordination and higher reflex and automatic movements) runs from cortex to pons nuclei, to cerebellum, to lateral fundamental column, via the peduncles, the fibers terminating at various levels in the anterior horn.

PLATE XIX.

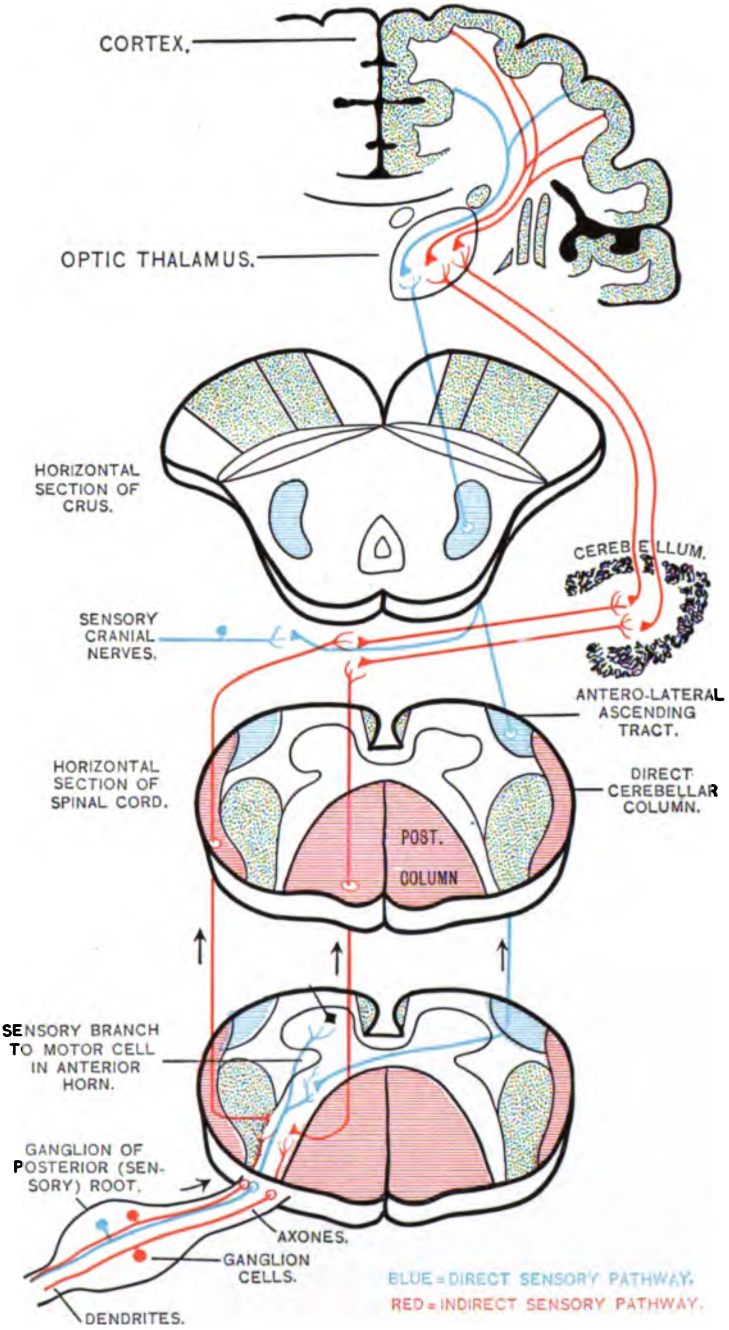

CORTEX.
OPTIC THALAMUS.
HORIZONTAL SECTION OF CRUS.
CEREBELLUM.
SENSORY CRANIAL NERVES.
ANTERO-LATERAL ASCENDING TRACT.
HORIZONTAL SECTION OF SPINAL CORD.
DIRECT CEREBELLAR COLUMN.
POST. COLUMN
SENSORY BRANCH TO MOTOR CELL IN ANTERIOR HORN.
GANGLION OF POSTERIOR (SENSORY) ROOT.
AXONES.
GANGLION CELLS.
DENDRITES.
BLUE = DIRECT SENSORY PATHWAY.
RED = INDIRECT SENSORY PATHWAY.

Fig. 149.—Sensory pathways. The *direct sensory path* (for touch, pain, and temperature, runs from the posterior root across the cord to the antero-lateral column, to tegmentum of crus, to optic thalamus, to cortex. The *indirect sensory paths* (for co-ordinative sensations from muscles, joints, and viscera) run upward on the same side, via the direct cerebellar tract and the posterior column, decussating at upper part of cord, to cerebellum, to optic thalamus and to cortex.

the blood in the arteries is increased, diminished in the veins, and there is an increased velocity of flow. With a constant aortic pressure, but a rise in the vena-cava pressure, there is a diminished velocity of flow, and consequently less blood in the arteries and more in the veins. Although without vasomotor influence the blood-supply to the brain is regulated by the arterioles of the skin and splanchnic area. Thus the latter contract when the oxygen supply to the brain is diminished, thus raising blood-pressure and furnishing a fresh supply of arterial blood to the cerebral capillaries. If the splanchnic mechanism is faulty, the abdominal vessels do not contract, hence the blood-pressure will not rise, and the blood accumulates in the abdominal veins and thus induces failure of the cerebral circulation. In some individuals with a disturbed splanchnic mechanism even a change from the horizontal to the erect posture causes faintness (page 408). Respiration influences the cerebral circulation by changing venous into arterial blood, and during inspiration the blood is sucked into the heart from the veins, and during expiration the augmented intrathoracic pressure impedes the entrance of blood into the heart and the pressure in the brain-sinuses is increased. During the latter phase of respiration there is increased intracranial pressure and the supply of arterial blood is diminished. Muscular effort, straining at stool, coughing, holding the breath (in a crying child), translates a normal negative into a positive pressure, and this fact is of importance in

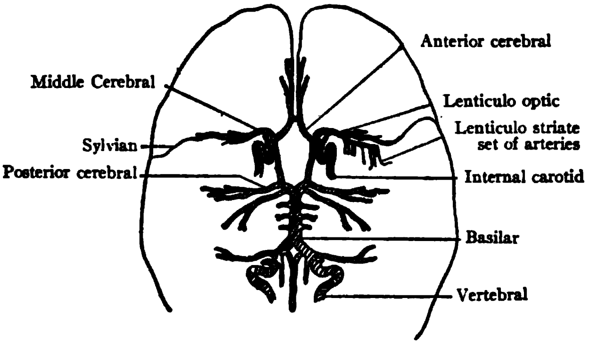


Fig. 150.—Illustrating arteries at the base of the brain. The "artery of cerebral hemorrhage," as it is called, refers to one of the lenticulo-striate set. (Modified from Dercum, after Butler.)

the etiology of apoplexy. The cerebral sinuses anastomose so freely that a number of them may be occluded without causing cerebral anemia.

Cerebral hyperemia is no longer countenanced as a clinical entity, although venous stasis and anemia are recognized. Acute cerebral anemia is marked by unconsciousness, whereas in the chronic forms dependent on nutritional disturbances and the anemias the subjects complain of giddiness, headache, noises in the ear, spots before the eyes, languor, and depression. ***Endarteritis*** of the cerebral vessels is very frequent. Reference has already been made to some of the symptoms of cerebral arteriosclerosis (page 379). Endarteritis is one of the chief causes of aneurism of the cerebral arteries and cerebral hemorrhage. In ***aneurism*** the middle cerebral branches are most frequently involved. The symptoms of a cerebral aneurism depend on the vessel involved, and are usually caused by pressure on important structures at the base of the brain. If the aneurism is large, auscultation of the skull may reveal a murmur. *Hemorrhage* usually involves the branches of the middle cerebral arteries. Bleeding may occur in the sub-

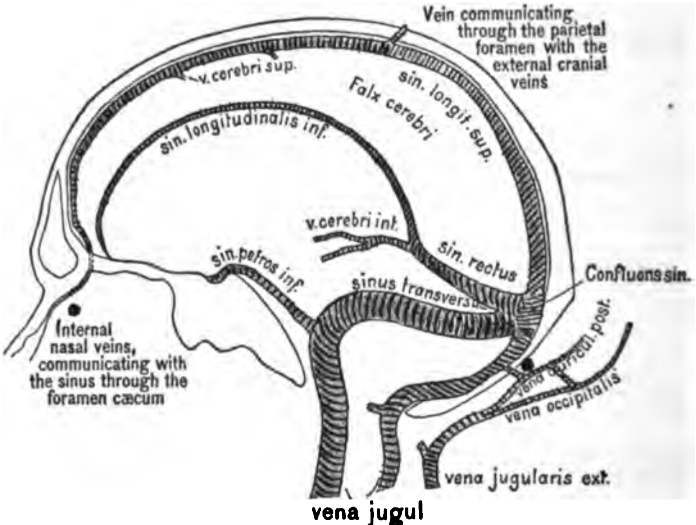


Fig. 151.—Diagram of communications of the superior longitudinal sinus and transverse sinus with external veins.

stance of the brain (cerebral apoplexy) or into the membranes (meningeal hemorrhage). Degeneration of the cerebral arteries usually leads to the formation of miliary aneurisms, the rupture of which in consequence of muscular exertion or emotions (causing increased action of the heart) is the most frequent cause of intracranial hemorrhage. A hemorrhage, however, may occur without rupture in the anemias, infections, and intoxications when the blood escapes by *diapedesis* through permeable walls. An *embolism* of the cerebral arteries in the majority of cases is a result of endocarditis. The embolus enters the left more frequently than the right carotid artery, owing to the more direct course of the former, and it usually passes into the left middle cerebral artery. *Thrombosis* is more frequent in the middle cerebral and basilar arteries. Embolism and thrombosis cause degeneration and softening in definite areas supplied by the vessels, and the symptoms correspond to the areas involved.

Increased Cerebral Pressure.—It has already been shown that the cranio-vertebral cavity is closed, the brain practically incompressible, and that the total amount of blood in the organ is invariable. If the cranial cavity becomes crowded in consequence, say, of tumors or foreign bodies, an equilibrium of pressure is attempted by the escape of cerebrospinal fluid into the more distensible dura of the cord and by a diminished secretion and increased absorption of cephalorhachidian fluid. There is, however, no constant relation between the size of a tumor and the increase of intracranial pressure, insomuch as a small tumor may cause an enormous rise in such pressure. It is evident that an essentially mechanic cause for augmented pressure may be excluded; and it is probable that even the presence of a tumor may cause an inflammatory condition in the arachnoid whereby the relation between the production and absorption of cerebrospinal fluid is disturbed, leading to increased cerebral pressure such as occurs in meningitis. An important symptom of augmented cerebral pressure is the *choked disc.* The cause of the latter is imperfectly understood, but the following hypotheses have been advanced: (1) That the increased intracranial pressure forces the cerebrospinal fluid into the optic sheath and by compression of the vessels causes venous stasis and edema; (2) that the cerebral inflammation extends along the optic nerve to the papilla; (3) that irritating substances pass from the cranial cavity to the optic disc. Other symptoms of increased cerebral pressure (stupor, vomiting, and slowing of the pulse and respirations) are dependent on arterial anemia and develop when the subarachnoid is greater than the arterial pressure.

Motor Disturbances.—Motor impulses to the muscles are conveyed by two sets of fibers: (1) Those which take their origin from the ganglionic cells in the cortical motor area and pass down into the pyramidal tracts to the cells of the anterior horns of the spinal cord or to the corresponding nuclei of the pons or medulla; (2) by fibers which arise from the motor cells of the cord and medulla. A total loss of voluntary motor power is known as paralysis, and when the loss is partial it is called paresis. The term amyasthenia is applied to a temporary weakness of a group of muscles, and is peculiar to hysteria. Within this domain the psychic paralyses may be included (page 716). According to the distribution of the paralysis, the following terms are employed:

1. *Hemiplegia* signifies a paralysis of one lateral half of the body, and it is called alternating or crossed when the paralysis involves the extremities of one side and the facial, ocular, or other muscles of the opposite side.
2. *Diplegia* refers to paralysis of like parts on either side of the body. It also signifies a double hemiplegia.
3. *Quadruplegia* signifies a paralysis of the four extremities.
4. *Paraplegia* refers to a paralysis of the lower extremities, but the term is qualified by reference to a paraplegia superior (when both arms are involved) and to a paraplegia inferior when there is a paralysis of both lower extremities.
5. *Monoplegia* refers to a paralysis of one extremity, and may be brachial (arm), crural (leg), facial (face), etc. A motor disturbance does not necessarily signify a lesion of the nervous system, insomuch as the disturbed motility may arise from lesions of the joints, muscles, blood-vessels, or bones.

Joints.—Paralysis or paresis may be simulated by pain in a joint or by mechanic limitation of its movement. In neuromimesis or hysteria the joint is rigid, and any attempt to move the limb causes much pain and excites a spasm of the muscles. The absence of objective signs beyond the superficial hyperesthesia and examination of the joint under an anesthetic usually betray the character of the affection. In neuromimesis it is claimed that the rigidity of the muscles reappears only when the consciousness of the patient returns, whereas in painful organic disease it reappears when deep anesthesia passes off (page 720). In organic disease of a joint an ankylosis may impair the mobility. The *ankylosis* may be false or true. The following facts indicate a false ankylosis: (1) Pain and spasm of the muscles when the joint is moved actively or passively; (2) during full narcosis some movement of the joint may be obtained, and the attempt causes pain or muscular spasm. In true ankylosis the muscles are wasted and relaxed, and under full narcosis no movement of the joint can be obtained and there is neither pain nor muscular spasm. Diseases of the joints may be followed by atrophy of the muscles throughout their entire length and not necessarily limited to the neighborhood of the joint. The extensors are usually involved and the grade of atrophy bears no relation to the intensity nor character of the articular lesion. After anesthesia cutaneous sensitiveness first reappears, and only later the profound tenderness in psychoneurotic joints. The contrary condition holds in organic joint affections.

Muscles.—Among the affections of the muscles which may involve their activity are: inflammatory diseases (polymyositis, trichinosis), the dystrophies, and parenchymatous degenerations associated with the infectious diseases. In myotonia congenita any attempt to move the limb is followed by a tetanic rigidity. In the curious affection known as myasthenia gravis, certain muscles become fatigued after slight exertion. Certain muscles supplied from the medulla are usually involved (asthenic bulbar paralysis), although all the voluntary muscles may become affected. Power is usually restored after rest. The myasthenic reaction is characteristic: rapid exhaustion of the muscles by faradism but not by galvanism. Up to 1900 sixty cases have been analyzed and twenty-three ended fatally. No lesions have been demonstrated anatomically.

Vascular Disturbances.—Reference has already been directed to intermittent claudication, thus demonstrating that the functional capacity of the muscles is dependent on an adequate blood-supply.

Types of Paralysis.—As a rule, paralysis may be divided into cerebral and spinal. In the cerebral type the central or upper motor neurones are involved and the paralysis is spastic and associated with contractures and exaggerated reflexes because the inhibitory influence of the central neurones is lost. The muscles do not atrophy nor is their electrical reaction modified because the trophic influence of the peripheral neurones is intact. The paralysis is usually a hemiplegia, because in cerebral paralysis the lesion is unilateral, and the paralysis is on the opposite side of the body from the lesion owing to the decussation of the motor fibers in the medulla.

In the spinal type, of which paraplegia is the most prominent form of paralysis, owing to involvement of the peripheral motor neurones, the muscles lose their tone and atrophy, hence the paralyzed muscles in this type are flaccid, atrophied, and show the reaction of degeneration. Reference to the accompanying illustration (Fig. 152) from Butler shows the effects of various lesions of the motor path.

Peripheral Paralysis.—Here the peripheral nerves which represent the conduction apparatus between the central and peripheral end-organs are involved. They conduct stimuli (centrifugal fibers) from the center to the periphery, or inversely (centripetal fibers) from the periphery to the center. It is often difficult to differentiate a peripheral from a central (cerebral or spinal) paralysis or anesthesia. The following facts speak for a peripheral paralysis: (1) Atrophy of the paralyzed muscles and the reaction of degeneration. (2) If the peripheral nerve has mixed fibers, paralysis and anesthesia coexist, and the motor and sensory manifestations are strictly limited to the area of distribution of a nerve-trunk and its branches. (3) The etiology and the associated symptoms of a central trouble will aid in distinguishing a peripheral from a central affection.

Local Spasms.—A frequent motor irritative symptom is ***tremor***, which is essentially a clonic spasm affecting the muscles. In the norm a muscle is in a state of moderate tension owing to rhythmic impulses emanating from the motor cells. Such muscular contractions are not perceptible, but they are recognized as a tremor when the impulses become increased in strength. All varieties of tremor usually cease during sleep. In fibrillary tremor a rhythmic twitching confined to muscular fibers or bundles of fibers is frequently

PLATE XX.

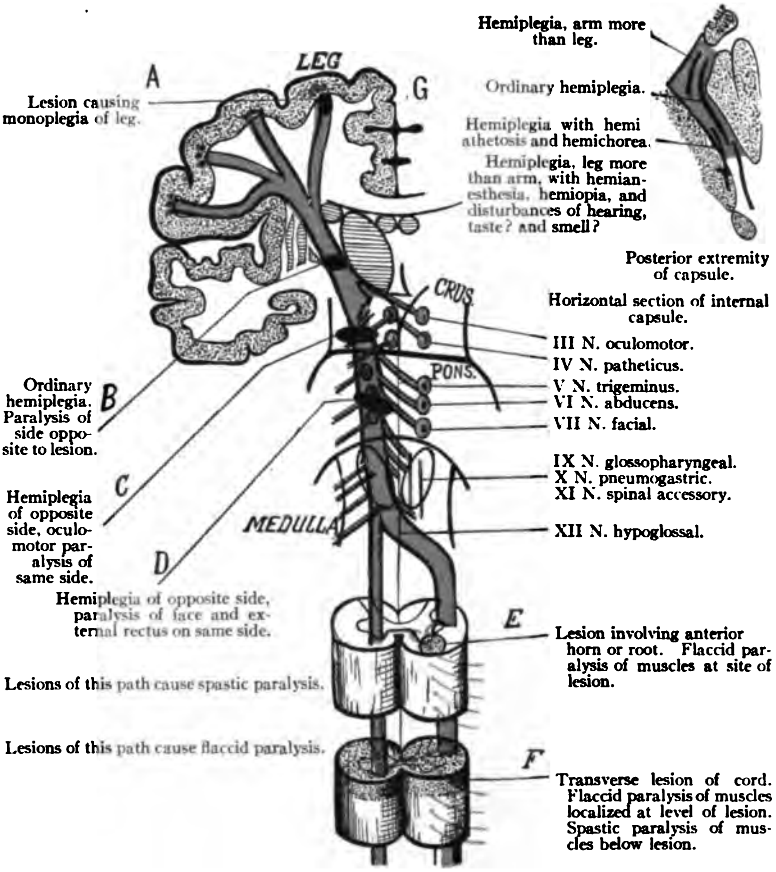

Hemiplegia, arm more than leg.
Ordinary hemiplegia.
Hemiplegia with hemi athetosis and hemichorea.
Hemiplegia, leg more than arm, with hemianesthesia, hemiopia, and disturbances of hearing, taste? and smell?
Posterior extremity of capsule.
Horizontal section of internal capsule.
LEG
A
G
Lesion causing monoplegia of leg.
CRUS
PONS
MEDULLA
III N. oculomotor.
IV N. patheticus.
V N. trigeminus.
VI N. abducens.
VII N. facial.
IX N. glossopharyngeal.
X N. pneumogastric.
XI N. spinal accessory.
XII N. hypoglossal.
Ordinary hemiplegia. Paralysis of side opposite to lesion.
B
C
Hemiplegia of opposite side, oculomotor paralysis of same side.
D
Hemiplegia of opposite side, paralysis of face and external rectus on same side.
E
Lesion involving anterior horn or root. Flaccid paralysis of muscles at site of lesion.
Lesions of this path cause spastic paralysis.
Lesions of this path cause flaccid paralysis.
F
Transverse lesion of cord. Flaccid paralysis of muscles localized at level of lesion. Spastic paralysis of muscles below lesion.

Fig. 152.—Showing the effects of various lesions of the motor path in the brain and spinal cord. The upper right-hand sketch shows the variations in symptoms caused by a difference in the antero-posterior position of the lesions in the internal capsule.

present in tired or atrophied muscles. When a muscle is struck in wasting diseases like phthisis, its increased irritability is manifested by a localized contraction of the fibers, and the phenomenon is known as myoidema.

Athetoid movements are noted in the independent affection known as athetosis and follow cerebral paralysis more frequently in children than in adults. When it involves the hemiplegic side, it is known as hemiathetosis. The movements are usually confined to the fingers and hands, although the toes and feet may also be involved. The movements are continuous and forcible, leading to flexion and extension of the fingers and toes and pronation and supination of the hands. Twitching of the muscles is observed in many grave affections, and is known as *subsultus tendinum;* and when the patient picks at the bed-clothes or attempts to seize imaginary objects, it is known as carphologia. Even small doses of strychnin in susceptible persons will cause twitchings in the muscles of the fingers, and when given to an individual with paralyzed muscles, twitching is first detected in the latter sooner than in the muscles under the control of the will. In *Jacksonian epilepsy* the spasm in a definite group of muscles may be preceded by a tingling or some other sensation in a part, and the spasm may then extend to all the muscles of a limb with undisturbed consciousness. This form of localized epilepsy indicates an irritative lesion (tumor, abscess, injury, etc.) in the sensori-motor zone of the cerebrum.

Choreic movements are involuntary spasmodic twitchings of muscle-groups. Tics are choreiform movements affecting muscle-groups which are physiologically related to perform definite functions. If a localized spasm affects an entire muscle, it is known as a cramp, and when the sural muscles are thus involved, attention is directed to gout, nephritis, or diabetes.

Contractures refer to a tonic muscular spasm of long duration. Such spasms develop when certain groups of muscles are paralyzed, thus causing excessive action of the unopposed antagonistic muscles which fix a joint in an abnormal posture. Contractures may be functional (hysteria) or organic (pages 209, 651).

Sensory Disturbances.—The cutaneous sensations consist of the tactile-sense (pressure and contact), the temperature-sense (heat and cold), and the pain-sense. There is some reason to believe that special nerves are concerned for each of the cutaneous sensations. The following terms refer to anomalies of sensation:

1. *Anesthesia.*—Loss of sensation, and when limited to one lateral half of the body, it is known as hemianesthesia. Hyperesthesia refers to excessive sensibility to tactile and other cutaneous sensations. When sensation is diminished, it is called hypesthesia.
2. *Allocheiria.*—This refers to a transference of sensation so that a stimulus applied to one side of the body is perceived by the patient on the opposite side.
3. *Polyesthesia.*—When the part touched with one point is felt as one or more points.
4. *Astereognosis.*—This refers to the inability to recognize the shape of objects by touch.

TESTS FOR SUFFICIENCY OF THE NERVOUS SYSTEM.

Symptomatic Tests.

Ataxia.—This signifies a failure of muscular coördination. A significant paradigm of ataxia is presented when a child first attempts to walk and is unable to control the muscles. Ataxia of the upper extremities may be determined by having the patient touch his nose, ear, or the finger of the physician with open and closed eyes. Ask the patient to button his coat, thread a needle, or write. Ataxia of the lower extremities is tested in various ways. Ask the patient to walk along a straight line or ask him to stand with closed eyes and feet placed together: if swaying of the body and inability to stand are noted, the patient has the Romberg sign and is ataxic. Standing first on one and then on the other leg will demonstrate mild grades of ataxia. If the patient is unable to walk, ataxia may be detected by having the patient touch with his toe the finger of the physician or with closed eyes request him to touch with his big toe some anatomic point of his other foot. Ataxia is always increased when the eyes are closed because the sense of sight is not able to correct the movements. In the affection known as astasia-abasia the patient is unable to stand and the legs give way. The latter affection is practically a symptom of hysteria and there is no incoördination nor paralysis.

ATAXIA.

DISEASE.	DIAGNOSIS.	LESION.
Locomotor Ataxia	Syphilitic etiology,* loss of knee-jerk, lightning pains in the initial stage, Argyll-Robertson pupil, ocular palsies, bladder and sexual signs, and gait (*q. v.*).	Posterior columns and posterior spinal roots. Lesions are also found in the cerebrum. Optic atrophy in 6 per cent. of all cases.
Hereditary Tabes (Friedreich's Disease)	Develops about the twelfth year. Ataxia begins in the legs and later involves arms and legs, disturbances of speech, spinal curvatures, absence of knee-jerk, nystagmus and the gait of a drunken man. It is a familial disease and several members of the same family may be affected.	Sclerosis of the dorsal and lateral columns of the spinal cord.
Central Ataxia	This may occur in focal lesions of the motor convolutions. Usually the paralysis associated with the lesion obscures the ataxia.	Motor cortex.
Ataxic Paraplegia	Traumatism and exposure to cold (not syphilis) are the usual etiologic factors. Sensory and eye symptoms are rare. The disease is characterized by a combination of ataxia and spastic paraplegia. The reflexes are increased.	Sclerosis of the dorsal and lateral columns of the cord.
Cerebellar Ataxia	A hereditary and familial disease occurring usually after the age of twenty. The gait is groggy, the knee-jerk is present, and a spastic condition of the legs develops. Various lesions of the cerebellum may produce ataxia, and when the patient is in bed coördinated movements can be executed. The incoördination is really a disturbance of equilibrium and the knee-jerk is present and there are no sensory disturbances.	In the hereditary disease, atrophy of the cerebellum was demonstrated in two cases. Usually the lesion in cerebellar disease is a tumor.
Polyneuritis	The usual etiology of multiple neuritis, especially alcohol. Preceded by neuralgic pain and tingling in the feet and hands. The foot-drop, the absence of pupillary symptoms, and the alcoholic etiology are diagnostic. The steppage gait may be confounded with the gait of ataxia, but the toe is lifted high in the air and the entire foot is forcibly placed upon the ground as a flail.	Inflammation and degeneration of the nerves and atrophy of the innervated muscles.

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* The therapeutic test in this disease with *mercury* is useless when the symptoms are stationary, but it may ameliorate the symptoms in the so-called form of syphilitic tabes when other symptoms of syphilis are present.

CHOREIC MOVEMENTS.

Disease.	Diagnosis.	Lesion.
Acute Chorea	A disease occurring between the ages of five and fifteen and lasting from eight to ten weeks. In the mild form the jerky irregular movements are limited to the hand or face, and in the severe form the irregular movements become general and the patient is unable to eat or dress. In maniacal chorea there are delusions and hallucinations, and it usually occurs in adult women. In paralytic chorea one arm may suddenly become weak and powerless.	No constant lesions. Embolism of the smaller cerebral vessels have been found. Endocarditis is more frequently associated with this than any other disease except rheumatism.
Hereditary Chorea (Huntington)	A chronic hereditary disease affecting other members of the same family, and the onset is rarely before the age of thirty. The gait is that of a drunken man, the speech is indistinct, and there is progressive mental impairment leading to dementia.	Supposed to be a chronic meningo-encephalitis with atrophy of the convolutions.
Habit Chorea or Convulsive Tic	As a habit-spasm a rapid contraction of some of the facial muscles occurs, or a shrugging of the shoulder, a short inspiratory sniff, pressing the nose with the finger, etc. In the convulsive tic we are dealing with a psychosis peculiar to children in which involuntary muscular movements are accompanied by explosive utterances in which a word is mimicked or repeated over and over again (echolalia) or bad language is used (coprolalia).	
Saltatory Spasm	Observed in neurotics, and is provoked when the patient attempts to stand. Violent contraction of the muscles of the calf and hip occur, causing the patient to jump or to throw him to the ground. Several members of a family may be afflicted and the affection may be epidemic.	
Hysterical Chorea	The movements are rhythmic and may involve any group of muscles, inducing facial spasm, wryneck, or nodding movements of the head (*spasmus nutans*).	

Choreic Movements.—These involuntary movements affecting the facial muscles cause grimaces; when they involve the muscles of articulation, they produce disturbances of speech, or irregular breathing when the muscles of respiration are affected. Application of the tests for *ataxia* will exaggerate the movements. Slight movements may be detected by having the patient place the palms of his hands upon the hands of the physician, and after this manner twitching of the fingers may be detected. Slight grades of tremor may be noted in chorea if the physician holds the extended hands of the child while the latter is speaking.

Contractures.—When a joint is fixed by contraction of the muscles around it, the condition is known as contracture. It is called an active contracture when the tension of the muscle is increased and a passive contracture when nutritive disturbances have caused a shortening of the muscle. An active contracture disappears during narcosis (page 209) after application of an Esmarch bandage (page 651), and it diminishes during a warm bath. When passive movements are attempted, an elastic resistance is felt, and it may yield partially. The corresponding tendon-reflex is increased. Passive contractures do not yield to the bandage, narcosis or warm bath, and the corresponding tendon-reflex is usually diminished. No passive movements are possible unless the muscular or tendinous tissue is torn. Active contractures fix the upper extremities in a position of flexion and the lower extremities in extension. Contractures conduce to deformities such as the various forms of club-foot, the claw-hand in ulnar and the ape-hand in median paralysis.

ACTIVE CONTRACTURES.	PASSIVE CONTRACTURES.
When not of hysterical genesis and dependent on an anatomic lesion, they are caused either by a secondary degeneration of the pyramidal tracts in consequence of some cerebral or spinal disease, primary systemic degeneration of the same tracts, as amyotrophic lateral sclerosis or spastic paraplegia.	These are produced whenever the muscular insertions are permanently approximated, as after the use of bandages in surgical diseases. In localized paralyses the antagonistic muscles which are not involved dislocate the affected extremity in their own direction and thus become shortened. The development of contracting connective tissue in the paralyzed muscles may overcome the force of even unaffected muscles, and in this instance the contracture is in the direction of the affected muscles.

Kernig's Sign.—This flexure-contraction symptom is a usual but not an invariable sign of meningitis. It may also be present in the absence of any clinical signs of meningitis. When present, it is confirmatory evidence of meningitis. It persists even during convalescence, and is one of the last signs to disappear. I have noted the presence of this sign in several cases of scarlatina during the period of delirium, and it was assumed that meningeal irritation (but not necessarily meningitis) existed. In the norm, when the thigh is flexed at right angles to the abdomen, the leg can be extended upon the thigh almost in a straight line; if the Kernig sign exists, the strong contracture of the flexors prevents the complete extension of the leg on the thigh. One must always flex the thighs upon the abdomen before attempting to extend the lower leg upon the thigh, otherwise the method is erroneously executed. More recently Kernig claims that this sign is only properly executed with the patient in a sitting posture, with the trunk and thighs so supported that they are constantly at right angles, and that his sign is elicited if the extension of the leg upon the thigh proves to be impossible in this position. He advocates Roglet's explanation of the sign, viz., pressure and irritation of the roots of the spinal nerves by the exudate which provoke a hypertonic condition of the muscles of the legs. The sign disappears with the onset of the paralysis and diminishes after spinal puncture.

Cutaneous Sensations.—In testing these sensations the eyes of the patient should remain closed, and he is instructed to say "yes" immediately when a sensation is perceived. In the norm it takes about one-tenth of a second before the patient responds to a stimulus, and in disease this time interval is lengthened. Every region of the body, including the mucous membranes, must be included in the examination, and the areas of disturbed sensation are outlined by means of a dermograph. The *tactile-sense* may be determined by an esthesiometer (dividers with blunted points), or the heads of two pins may be used with the eyes of the patient closed. Contact or touch is determined by drawing a camel's-hair pencil, a cone of cotton, or the finger over the skin, and symmetrical parts should be tested. Slight anesthesia may often be detected by touching the skin with the finger and then directing the patient with closed eyes to locate the point touched with his own finger. In the norm the patient does not fail in locating the spot to a greater extent than two inches. The *pressure-sense* is determined by having the

PLATE XXI.

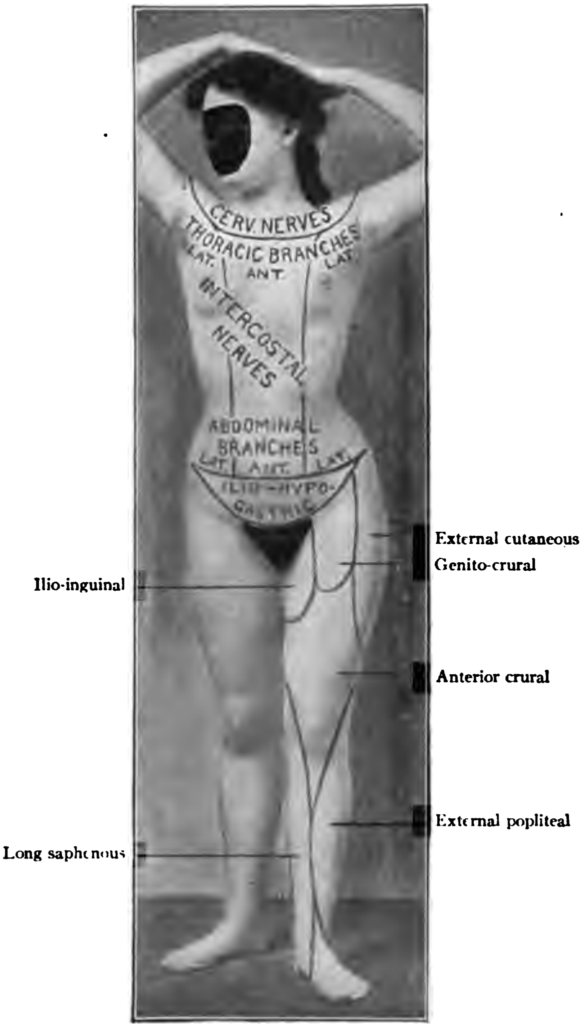

Fig. 153.—Showing the distribution of the sensory nerves of the skin on the anterior aspect of trunk and leg. (From Butler, with kind permission of D. Appleton & Co., New York.)

PLATE XXII.

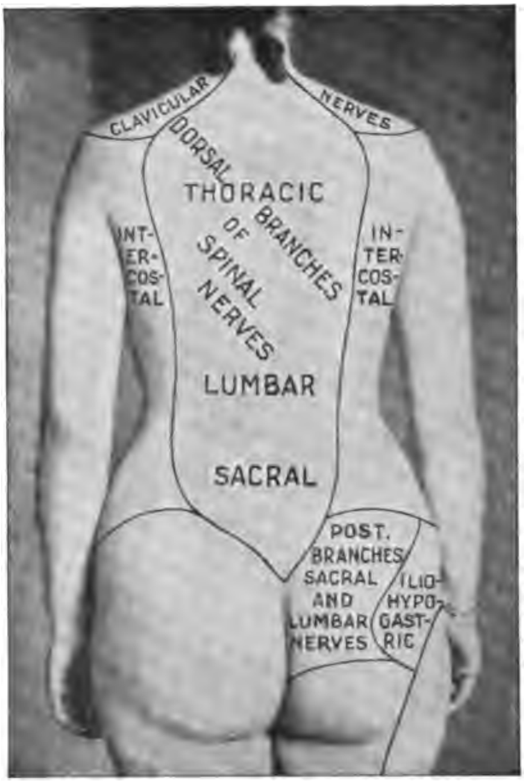

Fig. 154.—Showing the distribution of the sensory nerves of the skin on the posterior aspect of the trunk. (From Butler, with kind permission of D. Appleton & Co., New York.)

extremity rest on some support to exclude muscular action. A baresthesiometer may be used, but in the absence of the latter, coins of different weight may be placed upon the areas to be tested and the patient is asked to determine which coin is the heaviest. The *temperature-sense* is tested by means of test-tubes containing hot and cold water, or for all practical purposes breathing upon the skin of the patient with the mouth wide open (warmth), and again with the mouth nearly closed (cold), will suffice. The *pain-sense* is determined by the point of a pin. The *muscular-sense* is tested like the pressure-sense, but the limb is not supported. The *articular* and *tendinous-senses* are tested while the patient's eyes are closed. The limb is flexed, extended, and moved in different directions, and such movements are imitated by the patient with the corresponding limb of the opposite side, or the patient is asked to describe the position in which the limb is placed.

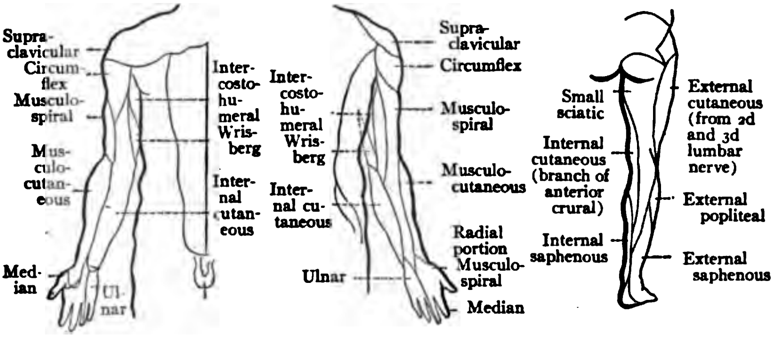

Fig. 155.—Illustrating the distribution of the sensory nerves of the skin of the anterior and posterior surfaces of the arm and the posterior surface of the leg.

Bone sensibility is tested by means of a tuning-fork (page 672).

It is important to recognize the distribution of the sensory cutaneous nerves so as to be able to differentiate a peripheral from a central anesthesia (Figs. 153, 154, 155).

ANESTHESIA AND HYPERESTHESIA.

Hysteria.—The anesthesia is usually confined to the left side (hemianesthesia) and terminates almost exactly at the middle line of the body. This hemianesthesia is almost pathognomonic of hysteria, and the patient does not usually know of the existence of the anesthesia and may complain of pain in the hemianesthetic area. This anesthesia involves not only the skin, but likewise the mucous membranes, muscles, joints, and organs of sense of the same side. The skin of the anesthetic side is usually anemic and a pinprick may not be followed by bleeding. The hysterical origin of the anesthesia may be determined by metallotherapy (page 595). In other instances there may be areas of anesthesia, or the latter may include the entire surface of the body. In the latter event, even if a small intact area is found, it emphasizes the hysterical character of the general anesthesia.

In some instances anesthesia may be limited to both lower extremities and the lower part of the trunk, and in such instances the sensibility of the skin of the genitals and a triangular area on the sacrum will be retained. The vibrating sensation (*vide* tuning-fork) may be employed, according to Williamson,[337] in the differential diagnosis between anesthesia due to organic disease and that caused by hysteria, traumatic neurosis, and malingering. On the sternum the vibrations of the tuning-fork are felt in the norm even when the foot of the fork rests only on the margins of the bone (points *A*, or *B*, Fig. 105), the vibration being transmitted across the bone. In hemianesthesia from organic lesions, if the foot of the fork is placed on the anesthetic side (*A*), though it might not probably produce any sensation at the point of contact, the vibrations would be transmitted across to the area of sensation, where the vibrating sensation would be felt.

In hemianesthesia, if the vibrating feeling is lost when the foot of the tuning-fork is placed on the edge of the sternum on the side of the tactile anesthesia, but felt on the other side, the case is one of hysterical or functional hemianesthesia, or of malingering; while in hemianesthesia due to organic disease the vibrating sensation is felt when the foot of the vibrating tuning-fork is placed on the edge of the sternum on the side of the tactile anesthesia.

In other instances areas of hyperesthesia may be demonstrated, notably over the ovaries and some of the vertebræ, the skin of the thorax and abdomen. The latter areas are called hysterogenic zones, and pressure upon the zones may evoke the manifestations of hysteria, even to the development of convulsions.

The localized areas of hyperesthesia may cause severe pain, especially in the head at a point corresponding to the sagittal suture. The latter pain has been compared to the driving of a nail into the part (clavus hystericus). The mammary gland, although showing no objective signs of disease, may be excessively tender, constituting the hysterical breast. Neuralgias are frequent, and hyperesthesia of the organs of sense is manifested by photopsy, tinnitus aurium, and accentuation of taste and smell. The patients may have itching and formication in the skin (paresthesia).

Neurasthenia.—Anesthetic areas in this affection are infrequent, but paresthesias (numbness and tingling) and areas of hyperesthesia may be localized on the spine and other parts of the body.

Traumatic Neuroses.—These cases may present symptoms of neurasthenia and hysteria, or may simulate organic disease. In traumatic hysteria all the sensory disturbances of hysteria may be present. Areas of hyperesthesia are variously distributed over the body, but especially localized in regions exposed to the traumatism and over the spine. Simulation in many cases may be detected by the test of Maunkopff: Take the pulse-rate before, during, and after pressure upon an area said to be painful, and if the pulse-rate is increased, the pain is real. Löwy[297] describes a pupillary reaction. When the pupils are contracted by an intense light, pressing on an organically diseased region is associated with a distinct relaxation of the pupillary ring, whereas if the localized pain is functional (psychic, as in hysteria), the phenomenon is absent.

Brain-lesions.—A tumor or hemorrhage located in the posterior third of the posterior limb of the internal capsule, where the sensory fibers pass upward, causes hemianesthesia and hemiplegia on the same side. Hemianesthesia and hemiplegia on the same side with oculomotor paralysis on the other side (crossed ocular paralysis), suggests a lesion in the crus on the same side as the ocular paralysis. A lesion of the upper portion of the pons is suggested when there is anesthesia of one side of the body with anesthesia of the opposite side of the face (crossed facial anesthesia). Lesions of the optic thalamus, or cortical or subcortical lesions of the parietal, temporal, or occipital lobes, may also, in rare instances, cause hemianesthesia.

Spinal Lesions.—Certain cutaneous areas correspond to different spinal segments (Figs. 156, 157). It is necessary to recognize such areas in diagnosis to determine whether anesthetic areas correspond to definite spinal segments, to different peripheral nerves, or are independent of the latter, as in hysteria. When the sensory path (Fig. 149) enters the cord, it crosses the median line of the latter, and pursues its course toward the brain on the opposite side containing the paths for touch, pain, and temperature. The muscular sense remains in the dorsal columns of the same side. In a lesion of the cord (paralyzed side) there is a zone of anesthesia (corresponding to the segments of the cord which are affected), but below this zone, sensation is either normal or increased. The muscular sense is not involved. On the other side of the lesion, however, and extending nearly to its level, the sensation for pain and temperature is completely abolished, and the tactual sense is impaired. A lesion like the foregoing is known as *Brown-Séquard's paralysis*, and is characterized by motor paralysis (hemiparaplegia) on the side of the lesion and sensory paralysis on the opposite side, with exaggerated reflexes. In this form of paralysis, which is frequent in syphilitic diseases of the cord, localized hemorrhages, stab-wounds, etc., the symptoms are not invariable, for the lesion is not strictly confined to the hemisection of the cord.

Anesthesia with motor paralysis of the lower extremities is encountered in various lesions of the cord (caries, fracture, dislocation, meningitis, myelitis, etc.). In compression-myelitis painful cutaneous areas may exist which show analgesia (anesthesia dolorosa).

Locomotor Ataxia.—Tingling and numbness in the feet and other sensations are common in this disease. Patients frequently complain of having no sensation in the soles of the feet and imagine they are walking on cotton or some other soft substance. Sensory disturbances in the hands are comparatively infrequent. One may demonstrate zones of anesthesia corresponding to the different spinal segments. A pin-prick on the foot may be perceived as a tactile sensation at once, but the sensation of pain may not be

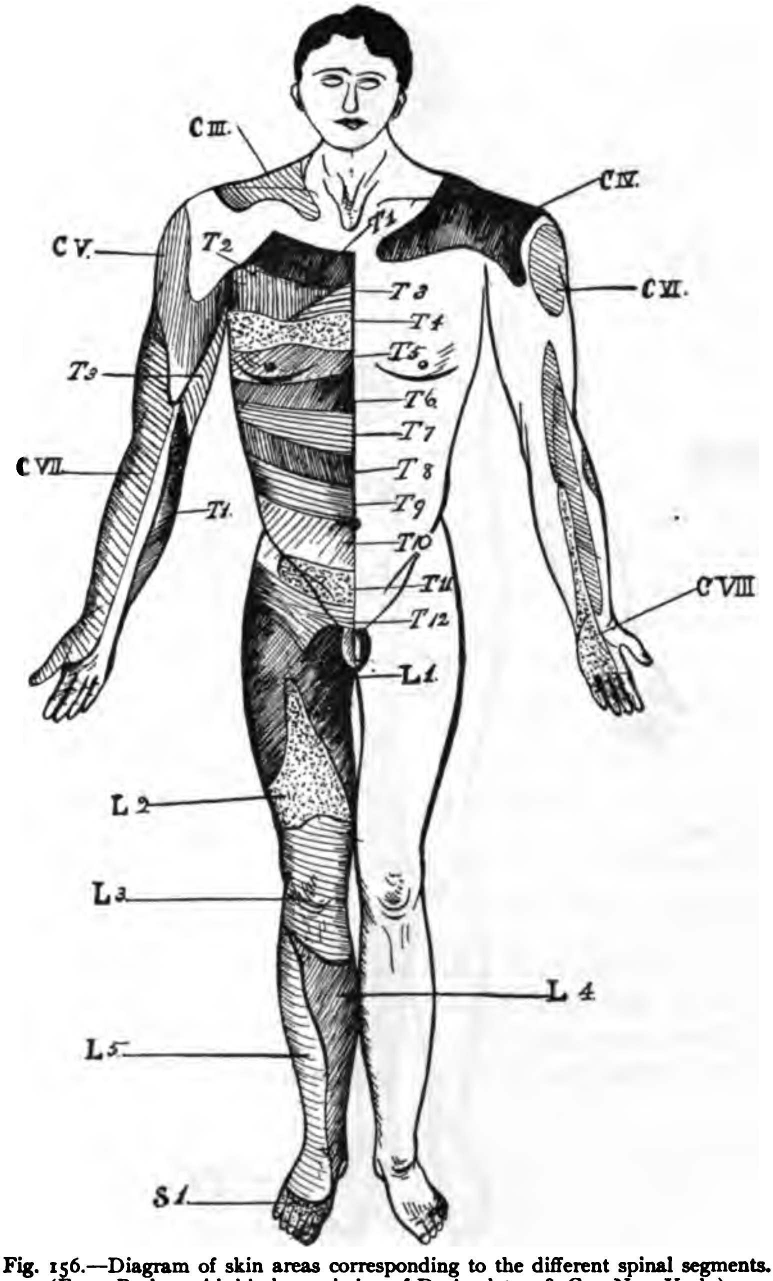

Fig. 156.—Diagram of skin areas corresponding to the different spinal segments. (From Butler, with kind permission of D. Appleton & Co., New York.)

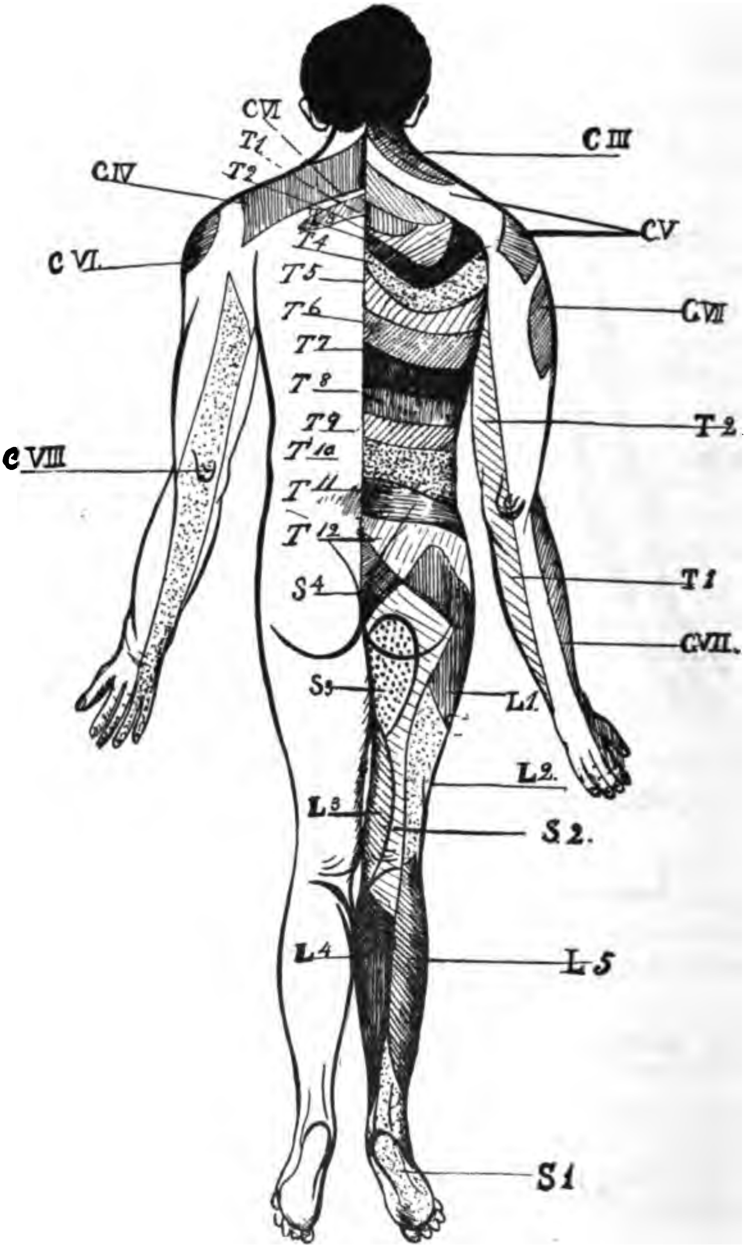

Fig. 157.—Diagram of skin areas corresponding to the different spinal segments. Combined from Head's diagrams by Osler. (From Butler, with kind permission of D. Appleton & Co., New York.)

perceived for several seconds later, when it may persist. In the phenomenon known as allocheiria a pin-prick on one may be felt on the other foot, or it may be felt on both feet simultaneously. The muscular sense is impaired even in the early stages of the disease.

Syringomyelia.—This affection is characterized by a gliomatous new-growth around the central canal of the spinal cord with the formation of cavities. A mere dilatation of the central canal is known as hydromyelus. In syringomyelia the tactile and muscular senses are usually intact, but painful sensations (analgesia) and thermic sensations (thermo-anesthesia) are not recognized. Tactile sensation is present because the postero-lateral columns are not impaired, and analgesia and thermo-anesthesia exist because painful and thermic impressions are conveyed to the brain by the tissue surrounding the central canal (peri-ependymal gray matter), which is usually involved in the pathologic process.

Neuritis.—Pain of various kinds is felt in the course of the affected nerves and the nerves are painful on pressure, swollen and firm, and in rheumatic neuritis subcutaneous nodules may be palpated. Even though the pain is present tactile sensation is dulled, and it is usually limited to the areas represented by the distribution of the involved nerves. In *leprosy*,* especially the anesthetic form, there are areas of anesthesia and hyperesthesia dependent on a neuritis caused by the development of the lepra bacilli in the nerve-fibers. The superficial nerve-trunks are enlarged and nodular. The pigmented spots of leprosy (macular form) even after their disappearance leave areas of anesthesia.

Acroparesthesia.—This is a condition of the peripheral nerves manifested by various sensations (burning, pricking, crawling, itching, and pins-and-needles) distributed over various parts of the body. It is an affection of adult life. Lesem,[274] who has recently studied this subject quite exhaustively, concludes that it is usually associated with circulatory and gastro-intestinal disturbances. In about one-half the patients indican was found in the urine and there was excessive alkalinity of the blood as determined by the hemalkalinometer. Vasomotor symptoms (hot and cold flashes) were also present. The best results were achieved by the use of increasing doses of strychnin combined with 15-grain doses of sodium bromid three times a day. Laxatives are also indicated.

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* Beaujard and Lhermitte (Semaine médicale, 1907, pp. 193–197) observed (which observation has been confirmed) that successive *x*-ray exposures of the spinal-cord region (dependent on the site of the lesion) are most efficacious in improving the symptoms of syringomyelia, whereas the same exposure is without effect in leprosy. Irradiation of the peripheral nerves, however, will cause a partial or complete evanescence of the symptoms in leprosy, but is without action in syringomyelia. Thus the rays in both affections are diagnostic and curative.

GAIT.

1. **Paraplegic Gait.**—Both legs are brought forward slowly and dragged on the floor, as is observed in paraplegia and in multiple neuritis.

2. **Hemiplegic Gait.**—The affected foot is dragged or the leg is circumducted by a twisting movement of the pelvis and then drawn forward.

3. **Ataxic Gait.**—This gait is characteristic of locomotor ataxia. In walking the foot is lifted high and then brought to the ground heel first or flat-footed with a stamp. The gait often resembles that of a fowl. The body is bent forward with eyes fixed upon the ground, to supplement, as it were, the disturbed muscular sense by vision. In the *cerebellar ataxic gait* (titubating gait) the individual walks like an intoxicated person. It is observed in lesions of the middle lobe (vermis) of the cerebellum, labyrinthine disease, paralyses of the ocular muscles, and in vertigo. The gait in question is also known as the staggering gait.

4. **Spastic Gait.**—This indicates a spastic condition of the muscles and is observed in all lesions involving the lateral pyramidal columns of the cord. The legs move stiffly, the knees are bent with difficulty, and the legs are separated laboriously if the adductors of the thigh are spastic. Very often the gait is jumping, owing to excitation of the tendon-reflexes when the foot is placed upon the ground.

5. **Spastic paretic gait** represents a combination of gaits 1 and 3.

6. **Festination.**—With head and body bent forward, the patient takes short, hurried, and shuffling steps and walks as if he were being pushed forward, hence the term propulsion, which

is also employed to describe this gait. In other instances the patient steps backward while his body is inclined forward (retropulsion). This gait is observed in paralysis agitans, and the patient's knees and elbows are usually flexed.

7. Waddling Gait.—The shoulders are thrown back and the back shows a depression owing to lordosis and the abdomen is protuberant. The feet are separated in walking and the body swings from side to side, giving rise to a waddling or "goose gait." This gait is characteristic of pseudo-hypertrophic muscular paralysis, and is also observed in congenital dislocation of both hip-joints, pregnancy, ascites, and abdominal tumors.

8. Steppage Gait.—Also called the pseudo-tabetic gait, is observed in neuritis of the anterior tibial nerve, and is a high-stepping walk, and when the foot is raised the toe is depressed owing to paralysis of the extensors of the foot. In the gait of sciatica the affected leg is fixed in the pelvis as in disease of the hip-joint, and in sciatic scoliosis the spine is usually bent toward the healthy side in standing or walking. In intermittent claudication the patient limps and rests from time to time. In Thomsen's disease every attempt to walk is associated with a painless spasm of the leg-muscles.

PAINS.

Pain may be parenchymatous or neuralgic. The former develops when the terminal branches of the sensory fibers are irritated, and the latter when the nerve-trunks, sensory roots, or sensory centers are irritated.

Parenchymatous Pain.	Neuralgic Pain.
Pain is diffused.	Pain usually limited to the involved nerve.
Pain is not pronounced.	Pain is usually severe.
Pain is continuous.	Pain is remittent.
The entire painful area is sensitive to pressure.	Certain parts of the nerve which lie superficially against a hard background are sensitive to pressure (*points douloureux*).

Among the other characteristics of neuralgias are: (1) In the area of pain the skin is either hyperesthetic or anesthetic (anesthesia dolorosa); (2) vasomotor phenomena (pallor or redness of the skin) accompany the paroxysms; (3) trophic disturbances (thinning, thickening, and roughening of the skin, pigmentations, loss or increased growth of hair) may occur in the involved nerve-district. *Simulated pain* may be detected, according to Müller, after the following simple method: If a painful spot is found, say in the back, the finger is fixed at a point distant (4 to 5 cm.) from the latter and the patient is requested to say whether the latter point is painful on pressure, which is answered in the negative; in the meantime another finger is fixed over the spot declared by the patient to be sensitive and the finger over the painless area is removed. This maneuver is rarely recognized by the patient, who will declare, if pressure is now made over the supposed painful area, that no pain is felt, for he believes that the finger is pressing on the area which he declared to be painless.

Hyperalgesic Skin-zones.—Head has shown that visceral disease is manifested by pain and disturbed sensation in definite cutaneous areas. To demonstrate the tender skin-areas, the head of a pin may be used or a fold of skin is gently pinched. In the figures 156 and 157 the separate zones are shaded differently, and the numbers and letters indicate the segments of the cord, the stimulation of which causes the development of the hyperalgesic zones. The zones in question may be of therapeutic import if one desires to influence the pains and the pathologic condition by counterirritation.

Paralysis.—In testing for paralysis or paresis the patient is directed to make voluntary motions or the latter are made against resistance. In unilateral paralysis the affected may be compared with the uninvolved muscles. A dynamometer may be used to test the strength of the hand. In paralyses of the extremities both arms and legs are raised and dropped simultaneously; the paralyzed extremity will be raised more tardily and fall more quickly than the uninvolved extremity. The joints must be carefully examined in all instances, insomuch as adhesions or other articular anomalies may suggest paresis.

Speech Disorders.—In this connection brief reference will be made to disorders of speech in cerebral disease. Such disorders may be divided as follows:

1. *Aphemia.*—This signifies that articulate words are spoken with difficulty or not at all. This blurring of speech is observed in apoplexy and in diseases of the pons and bulb.

2. *Aphasia.*—This signifies that the patient is able and willing to speak, but the words which he uses are not the words he desires to use. This loss of the power of expression is also manifested by signs or writing (agraphia). Aphasia has heretofore been associated with some disturbance of Broca's convolution. The latter was supposed to be the center for memories of articulate or motor speech, and was located in the posterior portion of the third frontal convolution. Marie[197] has recently shown that profound aphasia may occur when Broca's convolution is intact, and as its destruction is not necessarily accompanied by aphasia, he concludes that it is not specially concerned in the function of speech.

3. *Amnesia.*—This refers to a loss of memory for words or some defect of the association of ideas of things with ideas of words, and not, as in aphasia, with ideas of verbal action. In this condition the lesion is located in the sensory centers of the cortex behind the Rolandic area. In the latter region are located the visual and auditory centers. In amnesia, which is also called sensory aphasia, there are two chief varieties—mind-blindness or visual amnesia, in which the patient seeing an ordinary object has absolutely no conception of its use, and mind-deafness or auditory amnesia, in which ordinary sounds are not recognized.

To determine the presence of defects in speech the following tests may be employed:

1. If the patient cannot understand spoken words, presuming the patient is not deaf, the auditory word-center is affected and the subject has auditory aphasia or word-deafness.
2. Aphasia is present when words cannot be repeated.
3. If the patient cannot write from dictation either the auditory or visual word-center (or connecting fibers) is affected.
4. If the patient is unable to recognize ordinary objects and their uses, mind-blindness is present.
5. To test the connecting fibers from the visual word-center to the motor centers for movements of the hand in writing, the patient is requested to copy written words.
6. To test the fibers connecting the visual to the auditory word-center, the patient is requested to name the objects he sees or to read aloud.

Marie[197] regards the different aphasias as different degrees of the same disease, and the dominant feature in every case of aphasia is a deficient understanding of spoken language. Minor grades of aphasia escape demonstration if the patient is requested to execute a simple act. A series of commands like the following must be given: "There are on the table three pieces of paper of different sizes. Give me the largest piece, crumple up the middle-sized piece and throw it on the floor, and put the smallest piece in your pocket." In no case of aphasia observed by Marie was

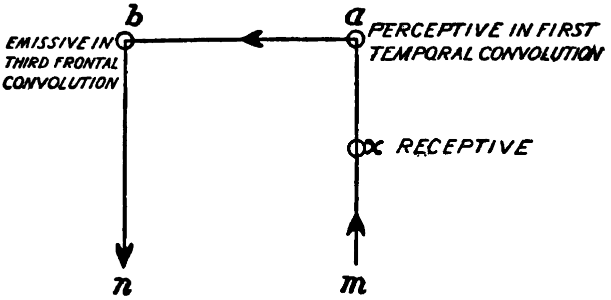
b
EMISSIVE IN THIRD FRONTAL CONVOLUTION
a
PERCEPTIVE IN FIRST TEMPORAL CONVOLUTION
x RECEPTIVE
n
m

Fig. 158.—Primitive speech apparatus of the child in the repetition of words mechanically (Wernicke and Lichtheim): *a*, Sensory speech center; *b*, motor speech center; *x*, acoustic center of pure sense of hearing; *m*, *x*, route to acoustic center; *b*, *n*, motor speech tract.

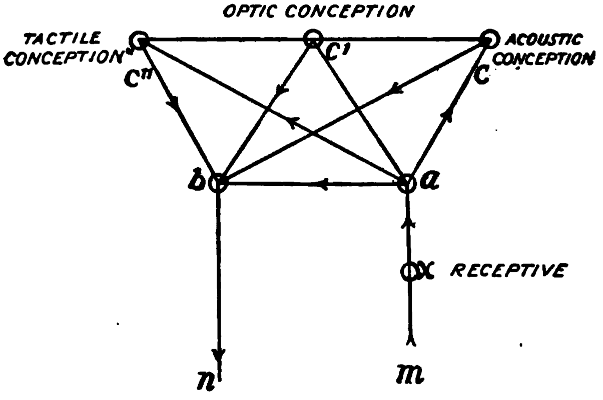

Fig. 159.—Showing the association of the various partial, to construct the whole conception or word-image of an object. The letters (*a*, *b*, *m*, *n*) have the same application as in Fig. 158, but *x* may indicate the seat of any of the special senses. In the word bell, the mental picture is made up of the acoustic conception (*C*), the optic (*C′*) from its appearance and from what is learned by touch (*C″*).

the patient able to execute the commands correctly. The lesion in aphasia is usually the result of a softening in the territory of the Sylvian artery. If the artery in question is completely blocked at its point of origin (*A B*, Fig. 160) there will be destruction of two-thirds or three-fourths of the hemisphere, including the intervening white matter, and the area of the affected cortex will embrace all those parts usually regarded as speech-centers. More limited lesions of the branches will produce the intellectual phenomena of aphasia, just as a lesion of any part of the sensory cortex will produce hemianesthesia, and the intensity of the symptoms will vary according to the extent of the cortex destroyed. It will be noted in Fig. 160 that if the lesion is located at *E H* at a point beyond where the branch going to the third frontal convolution is given off, all the typic symptoms of the aphasia of Broca may be present and yet the third frontal convolution will be absolutely intact. Among other lesions concerned in aphasia are cerebral hemorrhage, thrombosis, embolism, abscess, tumor, etc. One must assume a temporary ischemia of the speech-centers, due to a spasm of the Sylvian artery, in those cases of aphasia observed in hysteria, neurasthenia, migraine, and during convalescence from exhausting fevers. In such instances the amyl nitrite test may be employed (page 379).

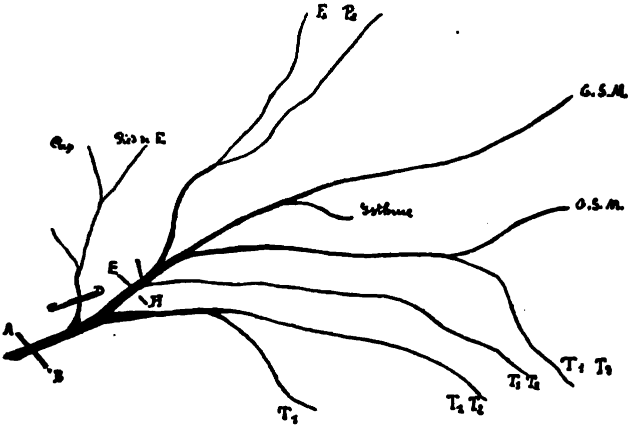

Fig. 160.—The left Sylvian artery.

TREMOR (TREMBLING).

AFFECTION.	DIAGNOSIS.
Disseminated Sclerosis (Multiple Sclerosis)	Volitional tremor or intention-tremor, and occurs when an attempt is made to perform certain acts. Most marked in arms and legs. Usually no tremor when the patient is at rest.
Paralysis Agitans	Tremor persists during repose and may be lessened by purposeful movements or inhibited by the will. Tremor rarely occurs in the head and is usual in the hands, as if the patient were rolling a pill between the thumb and forefinger.
Toxic Tremor	Intoxication from mercury, coffee, tea, tobacco, arsenic, and morphin. Alcoholic tremor is most marked in lips and hands during purposeful movements and may disappear after a large dose of alcohol. Tremor is an early and common symptom in *plumbism*.
Senile Tremor	A fine tremor (four to six oscillations in a second) occurring in elderly subjects. Begins in the hands and extends to the muscles of the neck, causing movements of the head. In slight cases it is an intention-tremor; but in advanced cases it continues during rest.
Tremors of the Neuroses	Observed in exophthalmic goiter * (hands), in neurasthenia, and in hysteria. The oscillations are fine and rapid (about eight to the second).
Hereditary Tremor	Dana reported cases of hereditary tremor in the members of one family which began in infancy and continued without serious results.
Simple Tremor	Transient tremor occurring in individuals without any apparent cause. It may occur after violent exercise, exposure to cold, emotions, etc.

Tremor when not apparent may be detected by directing the patient to extend his arms with separated fingers or to place the tips of the fingers against the physician's hand. Tremor of the facial muscles may be detected by directing the patient to show his teeth. Intention tremor is easily detected by having the patient carry to his mouth a glass filled with water.

Trophic Disturbances.—The muscles may be hypertrophied and show augmented muscular power, as in Thomsen's disease and in veritable congenital muscular hypertrophies. Usually the hypertrophy is false and the supposed increase in the volume of the muscles is due to fat and connective tissue, as in pseudo-hypertrophic progressive muscular atrophy. Atrophic muscles may become pseudo-hypertrophic.

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* It may be observed, according to Breuer, that in cases of exophthalmic goiter the symptoms may be made worse, or latent symptoms called out by administration of iodids. Kocher[234] asserts that iodin is taken up eagerly by the thyroid gland in exophthalmic goiter, and that in such patients it is not eliminated by the kidneys, as it is in normal individuals. Latent hyperthyroidism may also be detected by a few doses of iodothyrin, which will exaggerate the symptoms of the disease. Albutt, like others, who have observed enlargement of the thyroid gland during menstruation, made the epigrammatic statement, "every woman stands often at the gate of Graves's disease." In this disease exposure of the thyroid gland to the *x*-rays may be of benefit, and if so, the pulse-rate is considerably reduced after a few radiations.

Muscular atrophy may be non-degenerative or degenerative. The former variety is an atrophy of inactivity and is usually observed when the muscles have not been employed, as in painful affections, or when an extremity is mechanically fixed by bandages or splints. Degenerative atrophy signifies diminution of the contractile substance plus an increase of interstitial connective tissue, and is encountered in idiopathic primary disease of the muscles (dystrophies) and in the atrophic paralyses.

The dystrophies embrace the different forms of *progressive muscular atrophy*, which may be myopathic, neuritic, and spinal. In all these forms the muscles, either individually or in groups, gradually atrophy, and the muscular power diminishes in proportion to the atrophy, whereas in the atrophic paralyses the atrophy is preceded by paralysis. The paralyzed muscles show the *reaction of degeneration* even before diminution of the volume of the muscle is apparent.

Joseph Collins refers to a symptom of great aid in distinguishing the progressive muscular atrophy of spinal origin from that of neural origin; in the former the fibrillary tremor of the decaying muscles is a constant and almost pathognomonic symptom, while in its true form it never occurs in the atrophy of neural origin. Among the trophic skin-disturbances are decubitus, pigmentation, deformities, and loss of the nails, glossy skin, increased growth of the hair, etc. In all paralyses occurring in early life the growth of the bone is inhibited. The bones are usually fragile in locomotor ataxia and syringomyelia, and spontaneous fractures may occur. In tabetic arthropathy there is a painless destruction of the articular constituents, especially of the knee-joint. The trophoneuroses include Raynaud's disease, erythromelalgia (congestive neuralgia of the feet), angioneurotic edema (painless circumscribed edematous swellings of short duration), facial hemiatrophy, and acromegaly; the latter is characterized by hypertrophy of the bones and soft parts.

Vertigo.—Dizziness may be subjective when the subject feels as if he himself were rising and falling; objective, when objects appear to revolve; horizontal, when vertigo is present in the recumbent and disappears in the erect posture. Vertigo is usually an acute condition, but it may be chronic (*status vertiginosus*), and the gait of the patient is not unlike that of an intoxicated person. Vertiginous paroxysms may be accompanied by palpitation, nausea, vomiting, or temporary loss of consciousness. The pathogenesis of vertigo is unquestionably identified with some disturbance in the function of the semicircular canals of the labyrinth. The latter determine orientation, *i. e.*, the determining of one's position with respect to surrounding objects. The sensory tract to the canals is a branch of the auditory nerve called the vestibular nerve, which conducts impulses to the cerebellum, and from the latter situation to the cerebrum. The cerebellum cannot be regarded as the center of equilibration, for it is merely the primary station for impulses transmitted from the semicircular canals. If the cerebellum is removed in an animal or is pathologically involved, a staggering gait (cerebellar ataxia) occurs. The position of the body in space is derived from afferent impulses, which are received by the cerebellum, and are tactile, muscular, visual, and labyrinthine. In locomotor ataxia owing to involvement of the sensory tracts the tactile sense is diminished and the patient is unable to balance himself (ataxia). The same condition arises if the soles of the feet are experimentally frozen. In locomotor ataxia the incoördination may also be caused by a loss of the muscular sense; here visual impressions also operate, for when the eyes are closed the ataxia is more pronounced. Many individuals become giddy when looking at moving water or when objects are viewed under unusual conditions, as in the ascent of a mountain railway. Labyrinthine impressions are the most important of all afferent impulses. A section of the human semicircular canal (Fig. 161) shows it to contain a watery fluid (endolymph and perilymph). The canals are in three planes at right angles to each other (Fig. 162), and we are apprised of the movements of our body with regard to the three dimensions of space by means of impressions (excited by the varying pressure of the endolymph) conveyed by the endings of the auditory nerve. Artificial stimulation of the canals produces giddiness and movements of the head and orbits. Rapid rotation of the body will also cause vertigo, because we receive conflicting impressions concerning the relative position of the body to external objects.

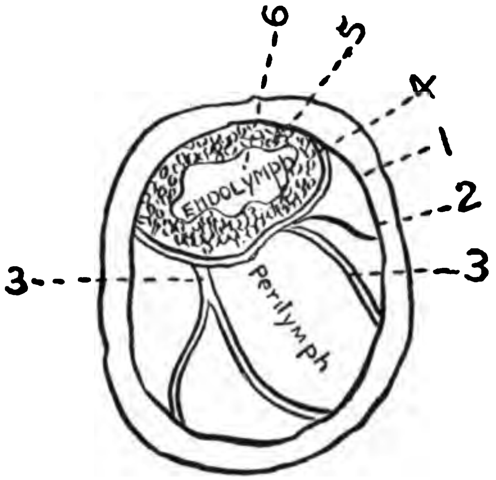

Fig. 161.—Section of human semicircular canal. 1, Bone; 2, periosteum; 3, 3, fibrous bands connecting the periosteum to 4, the outer fibrous coat of the membranous canal; 5, tunica propria; 6, epithelium (Rüdinger).

Causes of Vertigo.—1. In neurasthenia and circulatory disturbances (especially in arteriosclerosis) vertigo is probably caused by abnormal irritation of the semicircular canals.

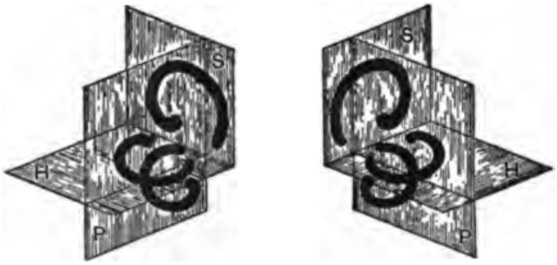

Fig. 162.—Diagram of semicircular canals, to show their positions in three planes at right angles to each other. It will be seen that the two horizontal canals (H) lie in the same plane: and that the superior vertical of one side (S) lies in a plane parallel to that of the posterior vertical (P) of the other (after Ewald).

2. Despite the fact that clinicians are inclined to ignore vertigo dependent on gastric disorders (*vertigo e stomacho læso* of Trous-

seau) and attribute the same to aural vertigo, treatment of a disordered stomach will often correct a persistent vertigo.

3. Seasickness is unquestionably a vertigo dependent on irritation of the semicircular canals by the oscillations of the ship, and is also in part an ocular vertigo. We know the importance of visual impressions in guiding the nervous centers for the maintenance of equilibrium. Thus it is that by closing the eyes many of the manifestations of seasickness may disappear. Fear also operates by autosuggestion in many instances, for we recognize the occurrence of vertigo in individuals who have a morbid dread of open spaces (agoraphobia). The vertigo of elevation, or mountain vertigo, belongs to the same category.

4. Ocular vertigo is due in part to a false projection of retinal images, and in part to a displacement of such images by ocular movement. In all instances of persistent vertigo the eyes must be examined to exclude errors of refraction, strabismus, or exophoria. When vertigo is caused by ocular paralysis, it disappears on closing one or both eyes. In suspected ocular vertigo the latter may be developed by having the patient look at objects in different directions so as to cause eye-strain.

5. *Laryngeal vertigo* is a reflex neurosis which causes more often a transitory syncope than vertigo in all forms of laryngeal irritation. For many years I have had occasional attacks of laryngeal syncope when particles of food or saliva passed into the larynx.

6. Vertigo either may form part of the aura of epilepsy, or, associated with temporary unconsciousness, may constitute the attack itself (*petit mal*).

7. Vertigo is especially frequent in labyrinthine diseases. Other diseases of the ear by directly or indirectly implicating the labyrinth may be associated with the symptom. In Ménière's disease (aural or labyrinthine vertigo) there are paroxysms of vertigo with tinnitus or partial deafness in one or both ears. Nausea and temporary unconsciousness may attend the attack, and in the intervals of the attack vertigo may be present. When Ménière's disease is dependent on a temporary increase of the endolymph or perilymph, subcutaneous injections of pilocarpin have been found to be efficacious; when dependent on augmented

arterial tension, nitroglycerin may be tried; and in still other instances quinin carried to cinchonism may be administered. Raymond employs the following test to determine defective functioning of the labyrinth even in the absence of vertigo: A small platform, suspended a little above the floor and turning on a central axis, is used to study the functioning of the vestibule. The individual to be tested seats himself on a chair on the platform, his back in a line with the central axis, his eyes bandaged. The platform is then gently turned on its axis. A normal individual recognizes that the platform is being turned, and can tell the direction. After one or two revolutions the platform is arrested, when the normal individual will feel as if the platform were still turning, but in an opposite direction to the first revolutions. This is the normal, physiologic sensation, and is explained by the behavior of the fluid in the vestibule. In case of a lesion in the vestibule the individual is liable not to perceive the motion of the revolving platform, or it may seem to him that the floor is sinking away under him.*

8. In certain parts of Switzerland and France and in northern Japan an epidemic paralytic vertigo has been described, characterized by paroxysms of weakness of the extremities, ptosis, and depression.

9. Vertigo is also symptomatic of cerebral tumors, disseminated sclerosis, and locomotor ataxia.

Vertigo of gastric origin is at least often temporarily inhibited by a dose of charcoal; if intestinal, an enema or purgative gives relief, and if dependent on cardiac failure, digitalis or strophanthus may be effective.

TESTS FOR CEREBRAL SUFFICIENCY.

Johnson made the pertinent observation, "Every man is a rascal as soon as he is sick." To paraphrase the latter annotation, all diseases are demoralizing and produce depression, irritability, and unreasonableness, and many of them lie on the borderland of insanity, for if the patients are not even mildly insane, their symptoms are often severe enough to make them so. There is a psychic factor in every disease, and many of the symptoms are typic or atypic manifestations of minor insanity. When the psychic element dominates the syndrome of certain neuroses, they are designated as psychoneuroses, which is a mitigated expression for insanity. Psychic diseases demand psychic treatment. The quack recognizes the psychologic aspect of disease, which some physicians studiously ignore. The therapeutics of the imagination, or the force of mind over body, is the real secret of quackery. It may be necessary to be an expert psychiatrician to recognize, but not to cure, mental anomalies, and the results at asylums prove the correctness of this observation. The brilliant diagnostician is very often an indifferent therapeutist, for the very evident reason that an ounce of moral treatment is worth a pound of drugs. The brain is the organ of the mind, and it is necessary to study the normal mind before we can appreciate its vagaries.

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*Vertigo may be caused by involvement of the labyrinth. By playing a small stream of cold (ordinary tap water) or warm water (48° C.) slowly upon the drum for five minutes with a syringe and canula, the patient responds with a rotary nystagmus if the labyrinth is normal; no reaction occurs if the labyrinth is destroyed as the result of some middle-ear process. The nystagmus may not occur until the end of the syringing if the drum is intact. Nausea may accompany the nystagmus.

Psychologic Tests.—There are no pathognomonic symptoms of mental disorders. An examination must include the physical state. The family and personal history must be taken into account as well as the mental and physical condition of the patient at the most critical period—puberty. Any stigmata must be noted. Thus, the skull along a line just above the external occipital protuberance to the glabella measures in the norm, for men, 55 cm., and for women, 53 cm.; yet only if measurements are below 48 or exceed 56 cm. must they be regarded as evidence of physical degeneracy. If the patient is in a stuporous state and will not respond to questions, the effects of external stimulation (pricking with a needle) should be observed. *Attention* is determined by the "one-hundred" test: the patient is requested to subtract 6 from 100 and to continue the subtraction down to zero. This test demonstrates mental fatigue and distractibility. *Associative memory* is tested by having the patient describe his illness and all facts associated with it. The power to *associate ideas* may be tested according to the method of Fuhrmann: 100 test words are printed on a slip and the patient is instructed, as soon as a word is called off to him, to describe the quality of the object named. The length of time that elapses between the announced word and answer is noted. Other methods of testing alienation will be described later.

Emotions.—Tarchanoff first demonstrated that when a galvanometer was placed in series with the human body, a deflection of the galvanometer occurred when the person was tickled or the sense-organs stimulated. The deflection likewise occurred when the person imagined the irritations. Scripture has studied this subject again. A sensitive galvanometer with two electrodes and a battery are employed. The current is sent through the hands of the person tested. According to my investigations, the person must be instructed to maintain the same pressure on the electrodes, for otherwise the galvanometer will show a deflection. To detect subconscious ideas the patient is requested to answer certain questions. Thus, "Is your married life happy?" "Do you fear that you have a disease of the heart?" etc. If the question arouses emotion, the galvanometer shows a deflection. After this manner, the hidden life of the subject may be unconsciously revealed.

In the diagnosis of insanity one must search for the psychic and physical stigmata of the neurotic or, more properly speaking, the psycho-neurotic constitution (page 710). One must also remember that a sound mind can only exist in a sound body, hence we must look for constitutional anomalies, notably in children, as possible somatic factors in the deranged equilibration. The frontiers of a mental anomaly in a child may be expressed by garrulousness, prevarication, turbulency, and inability to fix the attention. Those desirous of pursuing this interesting subject further may find much to interest them in the small book of Binet and Simon on "Les Enfants Anormaux."

The Mind.—There are three conspicuous manifestations of mind: (1) Thinking; (2) feeling; and (3) acting (volition).

All knowledge is derived primarily through the sense-organs, the stimulation of which produces *sensations*, and the conscious recognition of the sensation is known as *perception*. The latter is made up of percepts which, retained and reproduced in mind, constitute *memory*. Memory is a physical condition associated with definite brain areas. Thus, if the brain area connected with the memory of sound is injured or destroyed, the memory of sounds will be lost or impaired.

There is a memory of percepts and an organic memory. The latter constitutes the memory of self (ego), or the memory of all our personal impressions received from the various structures of the body in health and disease. In health we are strangers to many of our own life processes. Thus, in health "a man doesn't know that he has such a thing as a stomach, a dyspeptic doesn't know that he has anything else." *Personality* is the outcome of our varied impressions and is the essential part of ourselves recognized by consciousness. The power of voluntary conscious attention and personality are closely related. Thus an early symptom of insanity is weakening of the power of conscious attention, and the patient yields to irrelevant trains of thought; in other words, the individual in question is "a changed man" and his personality is altered. When memory gathers and arranges the percepts to form ideas or concepts, the mental process is known as *ideation*, and when these concepts are associated to formulate a judgment, the process is known as *reasoning*. A new idea developed from an association of ideas in the process of reasoning is a *judgment*. All our mental experiences are associated either with pleasure or pain, but in a few instances, when the concepts are attended with neither pleasure nor pain, they are neutral. Simple concepts which are neutral are *feelings* or affects, but when they are associated with a feeling of pleasure or pain, they are *emotions*. Many emotions are initiated like a brain-storm, and in their tumultuous force create energetic disturbances of the entire organism. *Volition*, or the power of willing, is an action initiated by desire and represents choice. Among the limitations of the will is to dismiss painful thoughts, and here is where psychotherapy asserts itself by introducing another idea which inhibits the action of the other. An idea expresses itself in some kind of external motion, and thus it is that man is an ideo-motor being. "It is impossible," avers Gratiolet, "to be seized by a vivid idea without the whole body being placed in harmony with this idea." We are all of us susceptibly credulous and intuitively accept sense-impressions as facts, and "a certain cerebral docility," says Bernheim, "compels us to obey commands."

ANOMALIES OF PERCEPTION.

Hallucination.—This is the perception of objects which have no real existence. The hallucination may be of taste, smell, vision, hearing, and tact. If a person sees men where there are no men, he has a hallucination of vision; if strange sounds are heard without any sounds to perceive, it is an auditory hallucination. Hallucinations may be dependent on anomalies in the sensory end-organs, *e. g.*, in the eye and ear. Thus an astigmatic may incorrectly translate visual impressions. There is a mental ear as well as a mental eye, and for that reason hallucinations of hearing and vision occur in those who have acquired deafness or who have become blind. There is nothing, however, in the mind which was not before in the senses, thus there are no hallucinations of sound in a congenitally deaf person. In brain-fatigue psychic often precede all other gross symptoms of fatigue. The mental traits last acquired—morality, will, and attention—become abeyant, and the traits first acquired in mental development obtrude themselves on consciousness. Hallucinations are frequent in brain-workers. The spontaneous and involuntary power of creating images which are accepted as realities is known as fantasy. Such hallucinations or phantasms are often experienced by intellectual workers just before going to sleep, in the twilight of the minds, and are described as hypnagogic. Snakespeare in the dagger scene of "Macbeth" describes a visionary phantasm:

> "A dagger of the mind, a false creation,
> Proceeding from the heat-oppressed brain."

Illusion.—This is the misinterpretation of the character of an object which has no real existence. If a person sees a chair and calls it a man, he has an illusion.

Clouding of Consciousness.—When the sense-organs are inadequately stimulated, the sensations fail to reach consciousness. Even in the norm when we are absorbed in work, we have no perception of sounds or other sensations. So it is in disease, that when the patient is occupied with his own sensations he is oblivious to external impressions, in other words, his consciousness is clouded. This clouding may range from partial consciousness to coma, and is a prominent feature in the different forms of delirium.

Disorientation.—A person is completely oriented when he recognizes his own position with respect to his environment. Orientation is temporal, spatial, and personal. If a patient cannot tell the day of the week, the city in which he lives, or does not know the individuals with whom he is brought into constant contact, he is disoriented with relation to the factors which concern his environment.

ANOMALIES OF THINKING.

Delusions.—These are false beliefs and result from disturbances in reasoning. A person who asserts he is the Almighty labors under a delusion. An expansive delusion or a delusion of grandeur is one which exalts its possessor. The grandiose ideas may embrace the possession of fabulous wealth, the undertaking of gigantic enterprises, etc. Delusions are fixed when they are constantly maintained; changeable, when they are replaced by other delusions; unsystematized, when they do not, and systematized when they do, influence the patient's conduct.

If the patient says he cannot chew his food and yet does so, his delusion is unsystematized, but it is systematized when he believes his food is poisoned and refuses to take it. In the one instance he has not, and in the other he has, the courage of his convictions. Now, there are a number of false beliefs which are not delusions. When the Zulu chews a piece of food to soften the heart of the man from whom he wishes to buy cattle, or of the woman he courts, or when the Bornean makes a wax figure of his enemy in the belief that when the image melts so will the body of his enemy waste away, they are false beliefs with reference to our mode of thinking, but they are fully in accord with the belief of the race. An individual may believe that a certain day is another day, and while it is a false belief, in reality it is only a mistake. Thus delusions may be sane or insane, and the latter are characterized as follows: (1) They are improbable, and not in accord with the education and environment of the individual. (2) No argument will convince the subject of the falsity of his delusive conception.

Obsessions.—These besetments refer to persistent ideas which occupy consciousness to the exclusion of other ideas. The patient recognizes the absurdity of the ideas, but they obtrude themselves nevertheless, dominate his thoughts, and often direct his actions. When the patient attempts to resist his actions, they become more persistent, until eventually the patient yields to the imperative conceptions. The most frequent of all the obsessions are the fears or phobias, some of which are as follows:

1. Aichmophobia is the fear of any sharp-pointed instrument. James I of England could never tolerate the appearance of a sword.
2. Thalassophobia is the fear of immense spaces. The moralist Nicole was forced to close his eyes and suffered from tremor when viewing a large expanse of water.
3. Agoraphobia is the fear of an open space and agoraphobes dread crossing the street.
4. Acrophobia signifies fear of high buildings.
5. Claustrophobia is fear expressed for narrow spaces.
6. Mysophobia is fear of defilement, and the sufferers are always worried lest their clothes, the toilet, or eating utensils may communicate infection.
7. Hematophobia refers to a horror of blood, an instinctive feeling among the civilized, but unknown among savages. A sect known as the Moravian Brothers had such an intense horror of bloodshed that they executed their condemned by tickling them to death.
8. Anthrophobia is the fear of society or people, while the antithetic condition, the fear of being alone, is called monophobia.
9. Bacillophobia is a constant dread of germs.
10. Kleptophobia is a fear of taking certain articles exposed to view.

Some fear syphilis (syphilophobia) or there is an unwarranted belief that they have the disease; others fear certain animals (zoophobia), and some people on seeing a cat experience various sensations, notably oppression of breathing (cat asthma); some fear death (necrophobia), which often assumes the magnitude of a monomaniacal besetment. Corning[196] describes his disciplinary method for the cure of the latter obsession. The patient is instructed to diminish the terror of death by thinking of sleep as death—not of death as sleep. That he must habituate himself to this idea by saying to himself when about to sleep, "I die now." Thus through auto-suggestion he is made to feel that he already knew the worst that death could inflict upon him, and that unconsciousness is the greatest of all boons. Again, he tries having an attendant keep the patient awake to convince the latter that the pangs of a consciousness unduly prolonged are the most convincing testimony to the supreme benevolence of death. Worry over the possibility of disease is known as nosophobia. Some individuals fearing to rise or walk, pass all their time in bed (stasophobia). An inability to stand (astasia) and to walk (abasia) is usually known as *astasia-abasia.* Then there are certain neurasthenics who fear to sit or rest in bed (acathesia). Marie, calling my attention to an acathesic at the Bicêtre, remarked that "the Wandering Jew" was evidently a victim of this phobia. The obsessions of doubt (*folie de doute*) concern the simplest acts. Thus the patient may get out of bed many times to determine whether he has turned off the gas or locked the door; he will open envelopes to note whether he has put the right letters in several envelopes. Fixed ideas occur when attention becomes so firmly fixed to a single thought that all others which do not harmonize with it are eliminated from consciousness. The individual whose apparently sole affliction is some morbid idea I have called an *ideopath.*

Dream States.—These refer to certain conditions in which the mind is occupied by dreamy ideas and the patient is usually oblivious of his environment. Hallucinations may occur in the dream state, and this clouding of consciousness is a condition of mental impairment peculiar to epilepsy.

Flight of Ideas.—In normal thinking our thoughts are consistently directed toward a definite object and all other ideas are subordinate to the idea in view. In flight of ideas the train of thought cannot be directed toward a definite aim. In this ideational disorder the patient is distracted by words or occurrences in his environment, and in consequence the train of thought is deflected. Thus any sensory impressions (noises and the exposure of new objects) may excite new idea-associations. *Circumstantiality* is related to the latter condition, although the goal idea is ultimately attained. Circumstantiality is normal in some women and in elderly individuals who cannot express a fact without relating interminable details.

Retardation.—This refers to difficult thinking, manifested by slowness of speech and hesitancy in answering or doing anything when requested (initial retardation) and retardation in answering or in executing a command (executive retardation). If a patient is requested to count, several seconds may elapse before the attempt is made, and when it is made the patient counts with difficulty. In *paralysis of thought* ideation is slow or absent.

ANOMALIES OF VOLITION.

Decreased and Increased Psychomotor Activity.—When voluntary impulses are executed with difficulty, we speak of decreased psychomotor activity (in depressive melancholia), and when the latter is exaggerated, as is manifested by restlessness and incessant action, it is increased, as in mania.

Impulsions.—These are made up of morbid conceptions and impulses. When morbid conceptions prompt the individual to commit an act, they become morbid impulses. The impulse may be harmless, and may consist of a repetition of words, a desire to touch certain objects, to count, and in more severe cases to steal (kleptomania), to set things on fire (pyromania), to drink (dipsomania) and to commit homicide or suicide. An attempt to resist such impulses is followed by a train of nervous symptoms (vertigo, trembling, weakness) which subside when the impulse is executed. When the impulse is characterized by repetition, it is known as *stereotypy*. In stereotypy of speech the patient constantly repeats words or phrases (verbigeration); in stereotypy of attitude, the patient maintains certain postures with the muscles in a condition of tension, and in the stereotypy of movements peculiar mannerisms are adopted.

Negativism refers to a condition in which the patient does just the contrary to what he is requested to do. In other words, the command excites an opposite motor impulse. In **suggestibility,** which is the opposite of the latter condition, the subject is abnormally responsive to suggestion. Words said in his presence are repeated (echolalia) or actions are imitated (echopraxia).

Anomalies of Memory.—When memory is completely lost or lost for definite events, it is known as *amnesia;* when it is falsified, *i. e.*, when things are remembered which never occurred, it is called *paramnesia* (*vide* Korsakoff's psychosis), and when it is exaggerated so as to include the most trifling details it is known as *hyperamnesia.*

Anomalies of the Emotions.—When the individual shows elation unwarranted by his condition or environment, he is in a state of *exaltation;* if, on the contrary, he is in a state directly opposed to the latter, his condition is one of depression, and if he is indifferent to his environment and manifests no emotions, the condition is known as *emotional deterioration.*

Ribot has coined the word *anhedonia* to designate a condition of indifference, in which the individual has lost the sense of emotional reaction. Such cases often occur in hepatic diseases. Esquirol relates the case of an intelligent magistrate who was a prey to hepatic disease, in whom every emotion within him appeared dead. The thought of his home, wife, and children influenced him as little as a theorem of Euclid. I have frequently encountered individuals suffering from intestinal auto-intoxication (in whom the liver is invariably tender on palpation) who were victims of anhedonia.

RELATIONS OF VARIOUS DISEASES AND FUNCTIONS TO INSANITY.

Physiologic Crises (Puberty, Maternity, Menopause, and Senility).—At *puberty* in both sexes a moral perversity may occur, manifested by a sudden disposition to steal, lie, swear, etc. It may be of long duration and finally result in incurable insanity. In girls, when menstruation is first established, excitement with delusions may occur.

Many writers have recently commented on the changes of temperament provoked by the thyroid body during menstruation, pregnancy, and the menopause, and it is asserted that the administration of thyroid substance will frequently modify the altered mental phenomena of such crises.

Dementia precox is a psychosis peculiar to puberty and is characterized by a period of depression succeeded by the following symptoms characteristic of *progressive dementia:* (1) Failure of memory and voluntary attention; (2) emotional deterioration; (3) lack of interest in themselves and their surroundings. The following types of dementia precox are recognized:

1. Simple dementia.

2. Hebephrenia, which is characterized by depression, delusions, hallucinations, and a poverty and flight of ideas.

3. Katatonia, which is manifested either as stupor or excitement. In the stuporous form there are signs of muscular tension, or the muscles may be put and retained indefinitely in any position (catalepsy or *flexibilitas cerea*). Negativism is also present. In katatonic excitement the patient shows constant activity. The association of excitement with dementia plus stereotypy will exclude the attacks occurring in manic-depressive insanity.

4. Paranoid forms. The premonitory symptoms of *paranoia* may be manifested in childhood. The child, although bright, may show certain eccentricities. Paranoia is a chronic progressive psychosis occurring in neurotics, and is apparently dependent on defects of development. It passes through the following stages: (1) The stage of subjective analysis, in which the patient develops hypochondriacal ideas. (2) The persecutory stage, in which hallucinations of hearing and systematized delusions of persecution develop. (3) The stage of transformation of the personality, in which the patient develops ideas of self-importance. He may believe that he is some exalted personage and that others are persecuting him to withhold from him his just rights.

The paranoiacs are the dangerous cranks who assassinate distinguished persons. Paranoia is an affection which often baffles an early diagnosis, for the subject is frequently quiet in demeanor, shows no intellectual impairment, and if he has systematized delusions, they are supported by logical argumentation.

Manic-depressive insanity may develop during pubescence. This form of insanity is manifested by recurrent periodic attacks of an exalted or depressed type and the intellect is not impaired. It has a manic and depressive stage. The former is characterized by flight of ideas, excitement, and depression, and the latter by decreased psychomotor activity, emotional depression, and retardation.

Maternity.—About 15 per cent. of the cases of insanity among women occur during the performance of the functions of pregnancy, parturition, and lactation. Puerperal mania usually occurs two or three weeks after delivery. The attack is preceded by constriction of the head, disturbances of vision, insomnia, and excitement. The insanity when fully developed may amount to delirious mania.

Adolescence.—The individual may escape the pubescent crisis only to break down at the adolescent period (between thirty and thirty-five years). The predisposing cause of *general paralysis* (paresis) occurring at about this period, so sententiously expressed by Mickle, applies with equal cogency to other forms of adolescent psychoses: "A life absorbed in ambitious projects, with all its strongest mental efforts, its long-sustained anxieties, deferred hopes, and straining expectation." "Burning the candle at both ends" is equally expressive in describing the predisposing factor in the etiology of the disease in question. Practically all cases of paresis show a history of syphilis. The mental symptoms are gradual and progressive and characterized by failure of memory and the moral sense, lack of judgment, fatigue after physical or mental exertion, and apathy. In lieu of apathy the expansive type of the disease may be expressed by unusual mental and physical activity, egoism, and grandiose delusions. If in addition to the mental the following symptoms are present, the diagnosis is established: Inequality of the pupils, Argyll-Robertson pupil, optic atrophy, abolished knee-jerks, tremor of the tongue and lips, and slowness and hesitancy of speech. Severe forms of neurasthenia are often differentiated with difficulty from paresis, but the physical signs above described, if present, make an error in diagnosis impossible. Again, the neurasthenic is always given to an exaggeration of his ills; the paretic, on the contrary, is either apathetic or boasts of his condition of well-being. Cerebrospinal syphilis, alcoholism, and other affections may lead to an error in diagnosis, but the following description of Folsom is a masterly portrayal of incipient paresis: "It should arouse suspicion if, for instance, a strong, healthy man, in or near the prime of life, distinctly not of the 'nervous,' 'neurotic,' or neurasthenic type, shows some loss of interest in his affairs or impaired faculty of attending to them; if he become varyingly absent-minded, heedless, indifferent, negligent, apathetic, inconsiderate, and, although able to follow his routine duties, his ability to take up new work is, no matter how little, diminished; if he can less well command mental attention and concentration, conception, perception, reflection, judgment; if there is an unwonted lack of initiative, and if exertion causes unwonted mental and physical fatigue; if the emotions are intensified and easily change, or are excited readily from trifling causes; if the sexual instinct is not reasonably controlled; if the finer feelings are even slightly blunted; if the person in question regards with a placid apathy his own acts of indifference and irritability and their consequences, and especially if at a time he sees himself in his true light and suddenly fails again to do so; if any symptoms of cerebral vasomotor disturbances are noticed, however vague or variable."

Tabes may present the symptomatic picture of paresis; in fact, both diseases are regarded as identical; in other words, tabes may begin in the brain or cord, and as the symptoms of one or the other predominate, we have dementia paralytica (paresis) or tabes. When the symptoms of both diseases are present, the term taboparalysis is employed.

Climacteric Period.—At this time the functional activity of organs which began at puberty ceases. This turn of life occurs at about the age of forty-five in women, and in man between the ages of fifty and sixty years. Nervous and mental symptoms of a mild character are common to all women at the menopause. *Melancholia* is peculiar to this period, and is characterized by a prodromal stage made up of peculiar sensations in the head, vertigo, tinnitus, insomnia, and irritability. In this, or in a later stage, emotional depression, anxiety, and apprehension develop, and illusions and hallucinations are frequent. In the agitated form of melancholia the patients are in constant activity, whereas in melancholia attonita they are stupid, and remain in one position, however uncomfortable.

Senility.—This period, marked by retrograde changes involving the arteries and cortex of the brain, begins usually in the woman at the age of sixty, and in the man a few years later. The senium, however, may begin earlier (pre-senility). In *senile insanity* unsystematized delusions, emotional deterioration (childish characteristics), and amnesia for recent events are the characteristic symptoms. *Pre-senile insanity* is made up of persecutory and hypochondriacal delusions.

Psychoses of Infection and Exhaustion.—Delirium is associated with many febrile (febrile delirium) and infectious diseases (infection delirium) and may follow them (post-febrile psychoses). In febrile diseases the severity of the delirium is in proportion to the mental stability of the patient, and psychotic symptoms are more marked in unstable than in stable subjects. All the senses may be involved in the hallucinations, and there is clouding of consciousness, dreamy delusions, and disorientation. Infection delirium cannot be attributed to the fever, insomuch as it may develop before the advent of the fever, or when the latter is insignificant. Acute confusion and delusions of a persecutory character are frequent. In the post-febrile psychoses disorientation and delusions of persecution may be the result of the primary delirium or they may develop spontaneously as the result of exhaustion. The *exhaustion-psychoses* usually associated with hallucinations, clouding of consciousness, and dreamy delusions may succeed exhaustion following loss of blood, parturition, or mental shocks.

Acute Delirium (Bell's Mania).—This is a febrile disease of unknown pathology which pursues a rapidly fatal course. It is peculiar to women, and follows infection or occurs during convalescence from fevers. The mental symptoms develop early and are characterized by insomnia, hallucinations, and violent outbreaks. The temperature may range as high as 104° F. These rare cases may suggest typhoid fever, especially as there are cases of the latter disease which are initiated by intense delirium.

Autotoxic Psychoses.—Mental symptoms are encountered in uremia, diabetes, and gastro-intestinal diseases (page 134) and the diagnosis is made by the association of the psychic with the other manifestations.

Myxedema and cretinism may be cited as examples of the thyroigenous psychoses. In myxedema the stupidity and apathy may be followed by dementia. In cretinism the mental picture may be that of feeble-mindedness, imbecility, or idiocy. *Cretinoid idiots* are confined to definite localities, usually in closed, narrow mountain passes. They have a stupid, apathetic appearance, broad features, large mouth, hands, and feet, thick lips and tongue (macroglossia), harsh voice, shuffling gait, and goiter (characteristic). Cretinism differs from idiocy in its susceptibility to treatment by thryoid preparations.

Idiocy may be defined as a congenital or acquired arrested brain development associated with mental defectiveness and deformities and malformations of the body.

Imbecility is a less profound arrest of the mental processes as compared with idiocy, and imbeciles are susceptible of some improvement by training.

In **feeble-mindedness** the mental defect is slight and is improved by training. Under very propitious circumstances the feeble-minded person (unlike the imbecile) may be able to take a position in the world.

Toxic Psychoses.—Many drugs may cause mental disturbances (page 94). Symptoms often develop from abstinence rather than from continuous use of a drug, as in opiumism, or delirium tremens in alcoholism.

Alcoholism may develop all kinds of mental symptoms. Alcoholic pseudo-paresis is differentiated from true paresis by the presence of a polyneuritis and by the fact that the discontinuance of alcohol is followed by a remission of the symptoms and in some instances by recovery. Alcoholic pseudo-paranoia is characterized by delusions of jealousy and of marital infidelity. Epilepsy in an adolescent may be caused by chronic alcoholism, and the improvement noted after the withdrawal of alcohol is diagnostic.

Neuroses.—In *hysteria* the psychic condition is on the borderline of sanity and insanity, and many of the patients are actually insane. The manifestations are characterized by perversions in the moral sphere, a morbid craving for sympathy, deception, and in aggravated cases by hallucinations, delirium, convulsive attacks, and catalepsy. In *neurasthenia* we have fatigue-symptoms, depression, hypochondriacal ideas, impulsions, fixed ideas, and obsessions. In all individuals predisposed to mental and nervous diseases disturbances of the physical functions may lead to a condition of the mind in which the patient constantly fixes his attention on the morbid sensations. Such a condition is known as *hypochondria*, and the latter becomes *melancholia* when the imaginary troubles are actual delusions out of which the patient cannot be reasoned. In *epilepsy* the paroxysm may be preceded or succeeded by pre-epileptic and post-epileptic mental phenomena, embracing delirium, mania, or amnesia. In the intervals between the paroxysms the subjects may show irritability, partial grades of dementia, and delusions. Imbecility or idiocy may characterize epilepsy commencing in early life.

Cerebral Diseases.—A cerebral tumor, especially when it is located in the prefrontal region, may cause emotional instability, irritability, clouding of consciousness, and hebetude. Hallucinations may occur when the growth has invaded the sensory areas. After *apoplexy* there is practically always some mental impairment, which in many instances may proceed to dementia. *Arteriosclerosis* may present a mental picture akin to paresis. *Cerebral traumatism* may be followed by hysterical or neurasthenic symptoms, and when cerebral resistance is feeble, by the various forms of insanity.

SUFFICIENCY OF THE SPINAL CORD.

Topical Diagnosis.—In locating lesions of the spinal cord it is necessary to determine the segmental level of the lesion and its transverse extent.

Segmental Level.—Each segment of the cord represents a unit endowed with sensory, motor, trophic, vasomotor, and reflex functions. Each segment is named after the pair of nerves which take their origin from it and not with reference to the vertebræ. Thus, in the distribution of such nerves as contain sensory or motor fibers, from the location of the peripheral sensory or motor disturbances conclusions may be formulated with relation to the segmental level of the lesion in question. It is evident that the peripheral disturbances are not limited to individual muscles or nerves. As before remarked, the point at which each nerve arises from the cord does not correspond to that at which it emerges. The root origin of the cervical and dorsal spinal nerves with reference to the veterbral spines may be determined as follows:

1. For the first four cervical nerves subtract one from the number of the nerve. Thus, the root origin of the third cervical is opposite the second spine.

2. Four lower cervical and upper six dorsal, subtract two from the number of each nerve.

3. Six lower dorsal, subtract three from the number of the nerve. Thus, the root origin of the ninth dorsal is opposite the sixth dorsal spine.

4. The lumbar nerves take their origin near the tenth and eleventh dorsal spines and the sacral nerves between the eleventh dorsal and first lumbar spines.

In Fig. 163 the relation of the segments, roots, and exits of the nerve to the vetrebral spine is shown.

Segmental sensory localization in the cord is represented in Figs. 156, 157, and if the areas of anesthesia correspond to the areas in the figures, the site of the lesion may be determined.

Segmental motor localization is determined by noting the loss of power in definite groups of muscles. In the following table, which has been prepared by Osler from the studies of Starr, Edinger, and others, is included the segments which control definite groups of muscles, the location of reflex centers, and the sensory areas (skin-fields).

LOCALIZATION OF THE FUNCTIONS IN THE SEGMENTS OF THE SPINAL CORD.

SEGMENT.	STRIPED MUSCLES.	REFLEX.	SKIN-FIELDS (Cf. Figs. 156 and 157).
I, II, and III C	Splenius capitis. Hyoid muscles. Sternomastoid. Trapezius. Diaphragm (C III–V). Levator scapulæ (C III–V).	Hypochondrium (?) Sudden inspiration produced by sudden pressure beneath the lower border of ribs (diaphragmatic).	Back of head to vertex. Neck (upper part).
IV C	Trapezius. Diaphragm. Levator scapulæ. Scaleni (C IV–T I). Teres minor. Supraspinatus. Rhomboid.	Dilatation of the pupil produced by irritation of neck. Reflex through the sympathetic (C IV–T I).	Neck (lower part to second rib). Upper shoulder.
V C	Diaphragm. Teres minor. Supra and infra spinatus (C V–VI). Rhomboid. Subscapularis. Deltoid. Biceps. Brachialis anticus. Supinator longus (C V–VII). Supinator brevis (C V–VII). Pectoralis (clavicular part). Serratus magnus.	Scapular (C V–T I). Irritation of skin over the scapula produces contraction of the scapular muscles. Supinator longus and biceps. Tapping their tendons produces flexion of forearm.	Outer side of shoulder and upper arm over deltoid region.

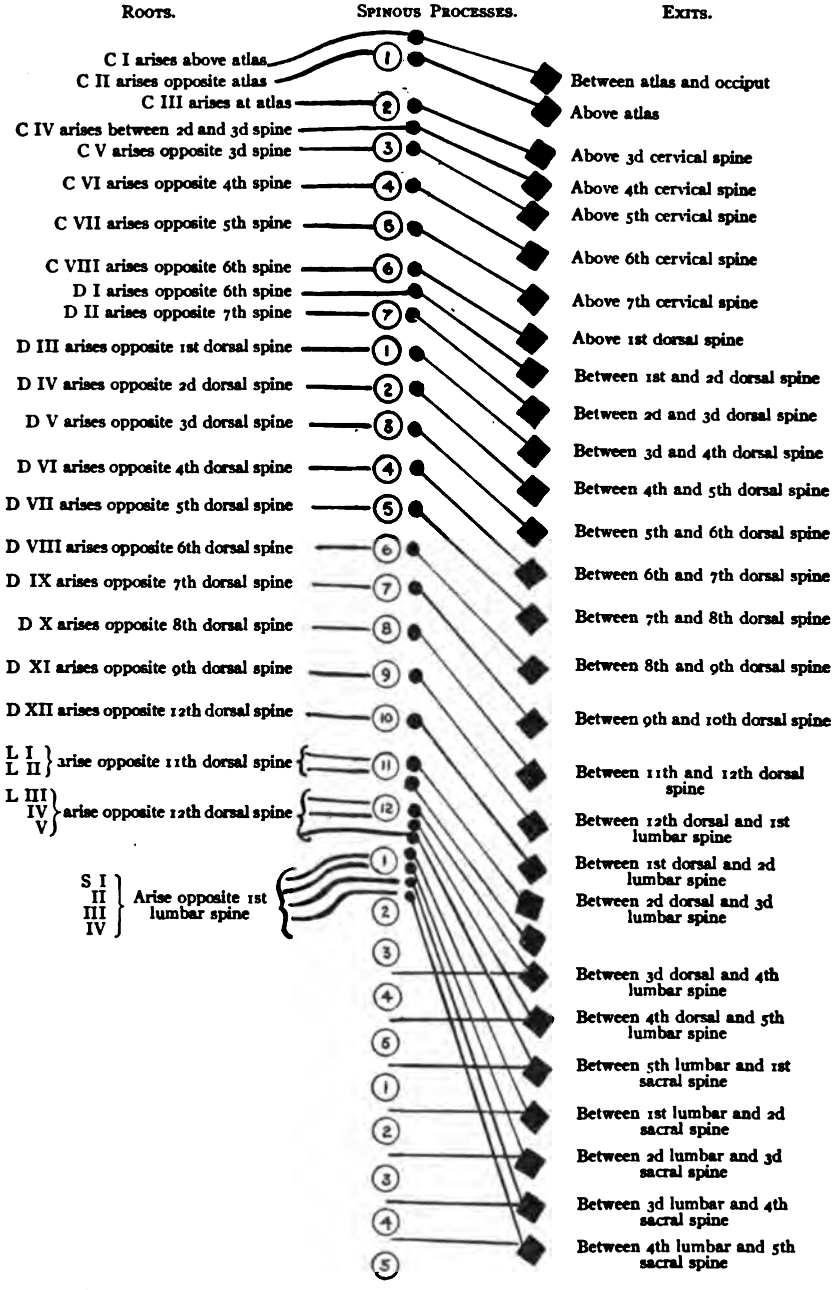

Roots.
Spinous Processes.
Exits.
C I arises above atlas
C II arises opposite atlas
C III arises at atlas
C IV arises between 2d and 3d spine
C V arises opposite 3d spine
C VI arises opposite 4th spine
C VII arises opposite 5th spine
C VIII arises opposite 6th spine
D I arises opposite 6th spine
D II arises opposite 7th spine
D III arises opposite 1st dorsal spine
D IV arises opposite 2d dorsal spine
D V arises opposite 3d dorsal spine
D VI arises opposite 4th dorsal spine
D VII arises opposite 5th dorsal spine
D VIII arises opposite 6th dorsal spine
D IX arises opposite 7th dorsal spine
D X arises opposite 8th dorsal spine
D XI arises opposite 9th dorsal spine
D XII arises opposite 12th dorsal spine
L I, L II arise opposite 11th dorsal spine
L III, IV, V arise opposite 12th dorsal spine
S I, II, III, IV Arise opposite 1st lumbar spine
1
2
3
4
5
6
7
1
2
3
4
5
6
7
8
9
10
11
12
1
2
3
4
5
1
2
3
4
5
Between atlas and occiput
Above atlas
Above 3d cervical spine
Above 4th cervical spine
Above 5th cervical spine
Above 6th cervical spine
Above 7th cervical spine
Above 1st dorsal spine
Between 1st and 2d dorsal spine
Between 2d and 3d dorsal spine
Between 3d and 4th dorsal spine
Between 4th and 5th dorsal spine
Between 5th and 6th dorsal spine
Between 6th and 7th dorsal spine
Between 7th and 8th dorsal spine
Between 8th and 9th dorsal spine
Between 9th and 10th dorsal spine
Between 11th and 12th dorsal spine
Between 12th dorsal and 1st lumbar spine
Between 1st dorsal and 2d lumbar spine
Between 2d dorsal and 3d lumbar spine
Between 3d dorsal and 4th lumbar spine
Between 4th dorsal and 5th lumbar spine
Between 5th lumbar and 1st sacral spine
Between 1st lumbar and 2d sacral spine
Between 2d lumbar and 3d sacral spine
Between 3d lumbar and 4th sacral spine
Between 4th lumbar and 5th sacral spine

Fig. 163.—Diagram showing the relation of the segments of the spinal cord, and of the roots and exits of the spinal nerves, to the spinous processes of the vertebræ. Black dots refer to points of origin, and black squares to points of exit. C, cervical; D, dorsal; L, lumbar; and S, sacral. (From Butler, with kind permission of D. Appleton & Co., New York.)

Localization of the Functions in the Segments of the Spinal Cord.—(*Continued.*)

Segment.	Striped Muscles.	Reflex.	Skin-fields (Cf. Figs. 156 and 157).
VI C	Teres minor and major. Infraspinatus. Deltoid. Biceps. Brachialis anticus. Supinator longus. Supinator brevis. Pectoralis (clavicular part). Serratus magnus (C V-VIII). Coraco-brachialis. Pronator teres. Triceps (outer and long heads). Extensors of wrist (C VI-VIII).	Triceps. Tapping elbow tendon produces extension of forearm. Posterior wrist. Tapping tendons causes extension of hand (C VI-VII).	Outer side of forearm, front and back. Outer half of hand (?).
VII C	Teres major. Subscapularis. Deltoid (posterior part). Pectoralis major (costal part). Pectoralis minor. Serratus magnus. Pronators of wrist. Triceps. Extensors of wrist and fingers. Flexors of wrist. Latissimus dorsi (C VI-VIII).	Scapulo-humeral. Tapping the inner lower edge of scapula causes adduction of the arm. Anterior wrist. Tapping anterior tendons causes flexion of wrist (C VII-VIII).	Inner side and back of arm and forearm. Radial half of the hand.
VIII C	Pectoralis major (costal part). Pronator quadratus. Flexors of wrist and fingers. Latissimus. Radial lumbricales and interossei.	Palmar. Stroking palm causes closure of fingers.	Forearm and hand, inner half.
I T	Lumbricales and interossei. Thenar and hypothenar eminences (C VII-T I).	....	Upper arm, inner half.
II to XII T	Muscles of back and abdomen. Erectores spinæ (T I-L V). Intercostals (TI-TXII). Rectus abdominis (T V-T XII). External oblique (T V-XII). Internal oblique (T VII-L I). Transversalis (T VII-L I).	Epigastric. Tickling mammary region causes retraction of epigastrium (T IV-VII). Abdominal. Stroking side of abdomen causes retraction of belly (T IX-XII).	Skin of chest and abdomen in oblique dorso-ventral zones. The nipple lies between the zone of T IV and T V. The umbilicus lies in the field of T X.

LOCALIZATION OF THE FUNCTIONS IN THE SEGMENTS OF THE SPINAL CORD.—(*Continued.*)

SEGMENT.	STRIPED MUSCLES.	REFLEX.	SKIN-FIELDS (Cf. Figs. 156 and 157).
I L...........	Lower part of external and internal oblique and transversalis. Quadratus lumborum (L I–II). Cremaster. Psoas major and minor (?).	Cremasteric. Stroking inner thigh causes retraction of scrotum (L I–II).	Skin over lowest abdominal zone and groin.
II L...........	Psoas major and minor. Iliacus. Pectineus. Sartorius (lower part). Flexors of knee (Remak). Adductor longus and brevis.	....	Front of thigh.
III L..........	Sartorius (lower part). Adductors of thigh. Quadriceps femoris (L II–L IV). Inner rotators of thigh. Abductors of thigh.	Patellar tendon. Tapping tendon causes extension of leg. "Knee-jerk."	Front and inner side of thigh.
IV L..........	Flexors of knee (Ferrier). Quadriceps femoris. Adductors of thigh. Abductors of thigh. Extensors of ankle (tibialis anticus). Glutei (medius and minor).	Gluteal. Stroking buttock causes dimpling in fold of buttock (L IV–V).	Mainly inner side of thigh and leg to ankle.
V L..........	Flexors of knee (hamstring muscles) (L IV–S II). Outward rotators of thigh. Glutei. Flexors of ankle (gastrocnemius and soleus) (L IV–S II). Extensors of toes (L IV–S I). Peronæi.	....	Back of leg, and part of foot.
I to II S.......	Flexors of ankle (L V–S II). Long flexor of toes (L V–S II). Peronæi. Intrinsic muscles of foot.	Foot reflex. Extension of Achilles tendon causes flexion of ankle (S I–II). Ankle-clonus. Plantar. Tickling sole of foot causes flexion of toes or extension of great toe and flexion of others.	Back of thigh, leg, and foot; outer side.

LOCALIZATION OF THE FUNCTIONS IN THE SEGMENTS OF THE SPINAL CORD.—(*Continued.*)

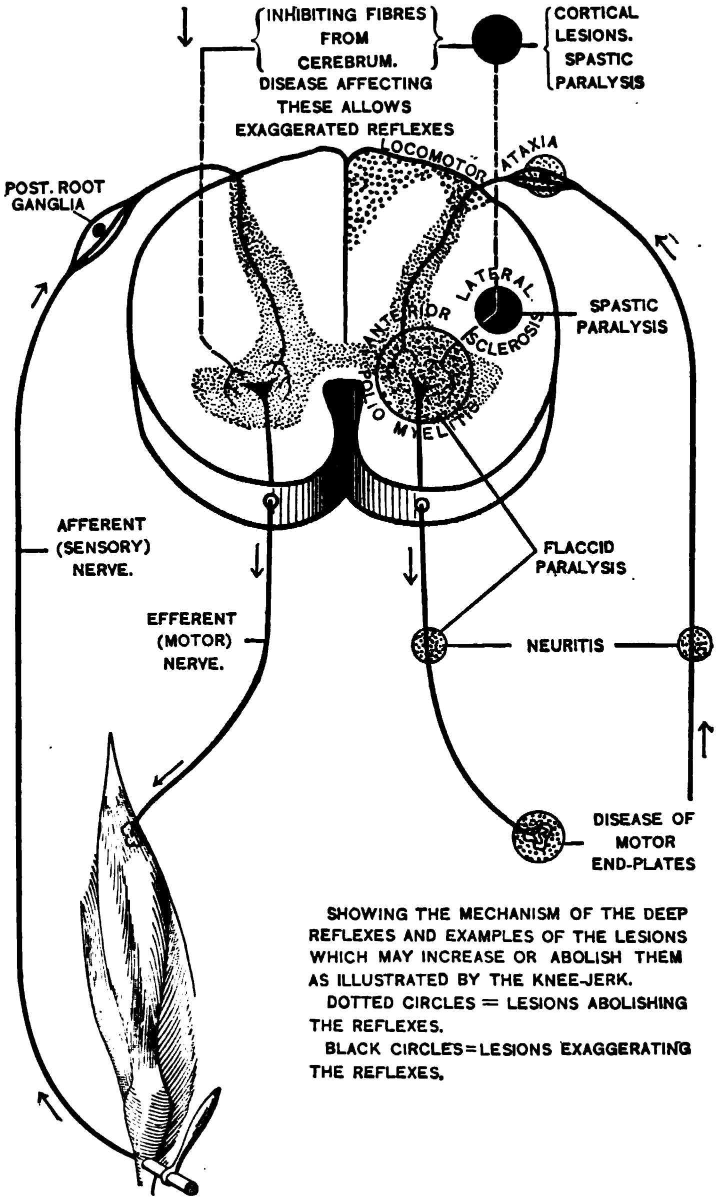
SEGMENT.	STRIPED MUSCLES.	REFLEX.	SKIN-FIELDS (Cf. Figs. 156 and 157).
III to V S.....	Perineal muscles. Levator and sphincter ani (S I–III).	Vesical and anal reflexes.	Skin over sacrum and buttock. Anus. Perinæum. Genitals.

Reflexes.—In the preceding table the presence of a reflex indicates that the reflex arc is intact. Reflexes are cutaneous or superficial, and deep or tendinous. When the reflex arc is intact, there is no interruption in the involuntary contraction of certain muscles, when a stimulus at the periphery (Fig. 164) is conveyed by an afferent nerve to the motor cells in the cord or medulla, where it is translated into a motor impulse and is in turn conveyed by an efferent nerve to the muscles. The superficial reflexes are so variable that their presence and not their absence is of significance. The knee-jerk and ankle-jerk are practically always present in health, but they are often involuntarily inhibited unless the attention of the patient is distracted, which may be usually accomplished by eliciting the reflexes when the eyes of the patient are closed. All reflexes are easily exhausted, hence no reflex may be elicited after the primary response, which must be carefully observed. As before remarked, the reflexes are not constant even in health, as is shown in the following table of Pflästerer:

MALES.

Epigastric reflex (upper abdominal-wall reflex)............	present	in	62	per cent.
Abdominal reflex (middle abdominal-wall reflex)...........	"	"	99	"
Cremaster reflex..	"	"	66	"
Plantar reflex..	"	"	98	"
Interscapular reflex....................................	"	"	15	"
Gluteal reflex..	"	"	28	"
Patellar reflex...	"	"	98	"
Achilles reflex...	"	"	57	"
Biceps reflex...	"	"	47	"
Triceps reflex..	"	"	48	"

Vertebral Concussional Reflexes.—By employing the same method for eliciting the spinal visceral reflexes (page 677), bilateral reflexes may be provoked by concussing the spines of definite vertebræ. Such reflexes are central, in contradistinction to the


INHIBITING FIBRES FROM CEREBRUM.
DISEASE AFFECTING THESE ALLOWS EXAGGERATED REFLEXES
CORTICAL LESIONS. SPASTIC PARALYSIS
POST. ROOT GANGLIA
LOCOMOTOR ATAXIA
LATERAL SCLEROSIS
SPASTIC PARALYSIS
ANTERIOR POLIO MYELITIS
AFFERENT (SENSORY) NERVE.
EFFERENT (MOTOR) NERVE.
FLACCID PARALYSIS
NEURITIS
DISEASE OF MOTOR END-PLATES

SHOWING THE MECHANISM OF THE DEEP REFLEXES AND EXAMPLES OF THE LESIONS WHICH MAY INCREASE OR ABOLISH THEM AS ILLUSTRATED BY THE KNEE-JERK.

DOTTED CIRCLES = LESIONS ABOLISHING THE REFLEXES.

BLACK CIRCLES = LESIONS EXAGGERATING THE REFLEXES.

Fig. 164.—Mechanism of the deep reflexes and the two main types (spastic and flaccid) of paralysis. (From Butler, with kind permission of D. Appleton & Co., New York).

conventional cutaneo-peripheral reflexes. The author has not had sufficient opportunity to test the reflexes in question in pathologic cases, but he believes that they may yet prove of clinical value when there is any interruption to the afferent impulses, although the efferent tracts are intact. The concussion blow must be vigorous, although it is not especially agreeable to the patient. The aid of an assistant, who either supports the extremities or executes concussion, is necessary. At the time of writing the following reflexes (which are bilateral) have been elicited:

1. *Biceps, triceps, and wrist-jerk*, by concussion of the fifth and sixth cervical vertebræ. The upper extremities must be placed in a state of flexion, with muscles absolutely relaxed and the elbows resting in either hand of the assistant. The elbows may also rest on a table in the flexed position and relaxed.

2. *Pectoral reflex*, by striking the dorsal spinous processes from the third to the sixth. The patient lies on his side, and the arm is elevated to bring the pectoral muscle into slight prominence.

3. *Epigastric reflex*, by striking the seventh dorsal vertebra. This is elicited in the erect posture during the time breathing is suspended.

4. *Gluteal reflex*, by striking any of the lumbar vertebræ, and the reflex in question is increased in intensity as the last lumbar vertebra is approached. This reflex is not obtainable in the erect posture, but when the patient lies on his side.

5. *Cremasteric reflex*, when the first, second, and third lumbar vertebræ are concussed, and it is often present when not evoked after the conventional manner. This reflex is elicited in the erect posture.

6. *Adductor reflex* consists of adduction of both lower extremities when any or all of the lumbar vertebræ are concussed. The patient sits on a chair with both lower extremities extended and relaxed.

With a strong sinusoidal current a large electrode at an indifferent point, and a smaller one, with interrupter, applied over the different spinous processes, one may determine the localization of functions of the various segments of the spinal cord with relation to muscular contractions and reflexes. The *plantar reflex*, by sinusoidalization of the first and second sacral segments, is especially characteristic.

Erector Spinæ Reflex.—By concussion of the spinous processes of the lumbar vertebræ or the upper part of the sacrum with the patient in the knee-elbow posture a perceptible elevation of the back occurs with every blow. To the touch contraction of the dorsal musculature is not evident. This reflex may be of some value to the neurologist and orthopedist. When the muscles are tense in lesions of the vertebræ, this reflex cannot be elicited.

Pathologic Reflexes.—Here reference can only be made to the Babinski and equivalent reflexes and the ankle-clonus. If in the norm we irritate the inner side of the sole of the foot from the heel to the toes by stroking with a moderately sharp object, all the toes undergo plantar flexion; but if the great toe (and perhaps the other toes) undergoes dorsal flexion (Fig. 165), the Babinski reflex or phenomenon is present. The latter phenomenon is nearly always present in lesions of the pyramidal tract.

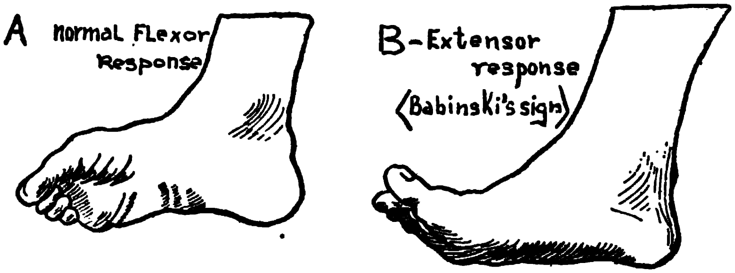


Fig. 165.—The Babinski toe-reflex.

The Oppenheim reflex is produced by stroking with the handle of a percussion hammer or other blunt object along the inner aspect of the leg below the knee at the posterior border of the tibia. The normal response is flexion of the toes, and in disease the toes are spread and extended with abduction of the foot. The Oppenheim and Babinski signs have practically the same significance, and one may be present and the other absent. The Gordon reflex has the same diagnostic value as the Babinski: placing the patient's feet on a chair, the reflex is elicited by having the examiner (always standing on the outer side of the patient) place his hand on the inner side of the tibia and then exert deep pressure on the calf muscles; the great toe or all the toes respond to this maneuver by extending. By deep pressure on the flexor muscles there is a response from the extensor, hence the use of the term paradoxic flexor reflex. The *ankle-clonus* is a rhythmic contraction of the muscles of the calf when the front part of the foot is dorsiflexed upon the leg with the right hand, while the heel rests in the left hand of the physician. The ankle-clonus is associated with an accentuated knee-jerk and is especially frequent in lesions involving the pyramidal tract. A spurious ankle-clonus is observed in hysteria and neurasthenia.

Tarsophalangeal Reflex.—By resting the inner surface of the leg and foot on a firm support with bent knee, and then lightly tapping with a percussion-hammer the dorsum of the foot in the region of the cuboid or external cuneiform bone, there is in the norm a dorsal flexion of the second and third or second to fifth toes. This reflex is absent, according to Von Bechterew, in patients suffering from certain organic brain-lesions of the motor nervous system, and in its place there is a plantar flexion of the same toes. This reflex is present in infants who show a positive Babinski, and both disappear at the same age. This reflex may be present when the Babinski is absent, although it is usual for both to be present simultaneously. Both reflexes possess the same significance.

Focal Lesions of the Cord.—The symptoms of lesions of the spinal cord are dependent on the area of the cord which is involved. Reference to the following table and to Fig. 166 will aid in determining the location of the lesion.

In the latter table reference is made to focal lesions, but a transverse lesion may be total, so that the lower part of the cord has completely lost the influence from above. When the lesion in question is complete, there is flaccid paralysis of the muscles below the level of the lesion, and if the paralysis is spastic, it indicates that the lesion is incomplete; the muscles atrophy, the tone of the sphincters is lost, and the anesthesia is total and extends to the level of the lesion. Unilateral lesions have been discussed.

TRACTS.	FUNCTIONS.	SYMPTOMS.	DISEASES.
1. Column of Goll. or Fasciculus gracilis....................	Conducts special sensations from the muscles, tendons, and joints of the same side and fibers cross above in the medulla.	Ataxia and loss of the muscular sense.	Tabes and Friedreich's ataxia.
2. Burdach's column, or Fasciculus cuneatus...............	Conducts tactile sensations from the opposite side and is crossed by afferent sensory fibers.	Pain, anesthesia, absent reflexes, and ataxia.	Tabes and Friedreich's ataxia.
3. Crossed or lateral pyramidal column.....................	The chief motor tract from the brain.	Spastic condition of the muscles.	Lateral sclerosis.
4. Anterior horns................	Motor and trophic cells for the muscles.	Paralysis and atrophy of the affected muscles.	Acute and chronic anterior poliomyelitis.
Posterior and lateral columns (1, 2, and 3)...............	*Vide* special columns.	Spastic paraplegia and rigidity of the muscles.	Ataxic paraplegia and primary combined sclerosis.
Anterior horns and lateral columns (4 and 3)..........	*Vide* special columns.	Atrophy and rigidity of the muscles.	Amyotrophic lateral sclerosis.
5. Central canal................	The central canal may be dilated (hydromyelus) or the cavity-formation is caused by *syringomyelia*. In the typical cases the cavity involves the cervical and thoracic portions, or the dorsal portion extending into one dorsal cornu, and thus it is that tactile sensation and the muscular sense are retained and analgesia and thermanesthesia are present.		

THE PERIPHERAL NERVES.

Neuritis.—An inflammation may affect a single nerve or a number may be involved, as in multiple neuritis or polyneuritis. Among the causes of a localized neuritis are: cold, traumatism, extension of inflammation from neighboring parts (joints, bones, and tumors) to the nerve, and from pressure in certain occupations (professional palsies). The etiology of polyneuritis is identified with infections, cachectic conditions, cold, drug-poisoning (page 93), and anesthesia (page 58).

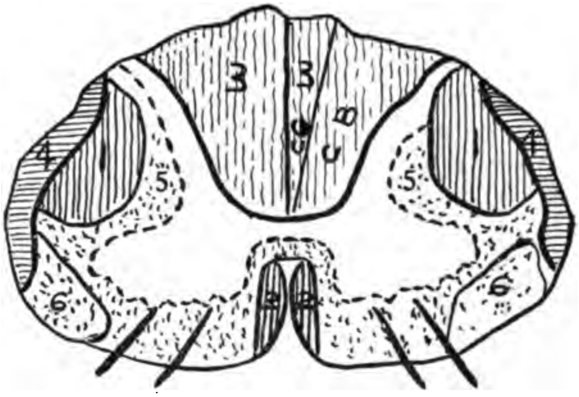


Fig. 166.—Cross-section of the spinal cord (after Van Gehuchten and Osler), illustrating motor and sensory paths: 1, Lateral pyramidal tract; 2, ventral pyramidal tract or direct pyramidal tract; 3, dorsal columns composed of the column of Goll (*c. G.*) and the column of Burdach (*c. B.*); 4, direct cerebellar tract; 5, ventro-lateral ground bundles; 6, ventro-lateral ascending tract of Gowers.

Both forms of neuritis have symptoms in common, but the constitutional symptoms are slight in the localized form. In the multiple form the onset bears a likeness to an acute infectious disease (digestive disturbances, chills, and a moderately high fever). The peripheral symptoms in both forms are: pains in the course of the nerve-distribution, the nerves are sensitive to pressure, and tactile sensation is impaired, even though pain is present (sensory symptoms). The motor symptoms consist of paresis and paralysis of the muscles and the reaction of degeneration may or may not be present. A neuritis, especially the traumatic forms, may extend upward (ascending neuritis) and may implicate large nerve-trunks or even the spinal cord and provoke a subacute

Upper Limb.

Post-thoracic	Serratus magnus.
Suprascapular	Supraspinatus. Infraspinatus.
Ex. ant. thoracic *Int. ant. thoracic*	Pectoralis major (upp. part, low. part). Pectoralis minor.
Musculo-cutaneous	Coraco-brachialis. Biceps. Brachialis anticus.
Subscapular	Subscapularis. Teres major. Latiss. dorsi.
Circumflex	Deltoid. Teres minor.
Musculo-spiral	Triceps. Ext. carp. rad. long. Supinator long.
Post. interosseus	Supinator brevis. Ext. carp. rad. brev. Ext. carp. uln. Ext. comm. digit. Ext. ossis metac. poll. Ext. primi. intern. poll. Ext. secund. intern. poll. Ext. indicis. Ext. minimi digiti.
Median	Pronator radii teres. Palmaris longus. Opponens pollicis. Abductor pollicis.

Trunk and Lower Limb.

Intercostals	Intercostals. Rectus abdominis. External oblique.
Branches of lumbar nerves	Erector spinæ. Quadratus lumborum.
Genito-crural	Cremaster.
Anterior crural	Sartorius. Pectineus. Rectus femoris. Vastus externus. Vastus internus. Crureus.
Obturator	Gracilis. Adductor longus. Adductor brevis. Adductor magnus (with sciatic).
Small sciatic	Gluteus maximus.
Sup. gluteal	Gluteus medius. Tens. vag. femoris.
Great sciatic	Biceps femoris. Semitendinosus. Semimembranosus. Adductor magnus (with obturator).
Int. popliteal	Gastrocnemius. Soleus. Tibialis posticus. Flex. comm. digit. Flex. long. hallucis.

Median and ulnar (jointly)	Flexor longus pollicis. Flexor carpi radialis. Flexor sublim. digit. Flexor brevis pollicis.
Ulnar......................	Flexor carpi ulnaris. Adductor pollicis. Muscles of little finger. Interossei.
Plantars....................	Flex. brev. hallucis. Flex. brev. digit. Abductor hallucis. Adductor hallucis. Ext. brevis. digit. Interossei.
Ext. popliteal................	Tibialis anticus. Ext. prop. hallucis. Ext. digit. longus. Peroneus longus. Peroneus brevis.

myelitis in the latter situation. Many of the paralyses secondary to visceral disease may be explained by an ascending neuritis. It is probable that in the toxic forms of neuritis the toxic substance has no specific attraction for nervous tissue, but travels up a nerve by aid of the lymphatics of the latter (Field).

Neuromata.—The tumors found on nerves may be made up of nerve-substance (true neuromata) or of fibrous tissue (false neuromata). In *plexiform neuroma* congenital or hereditary tumors are found on many nerves, and are usually painless on palpation. When multiple neuromata involve the cutaneous sensory nerves, they may be felt as subcutaneous painful nodules (*tubercula dolorosa*). The amputation neuromata formed on the central ends of injured or divided nerves are usually painful and may recur after removal. In *Recklinghausen's disease* (generalized neurofibromatosis) the multiple neuromata present a picture not unlike that of plexiform neuroma. The growths in Recklinghausen's disease may attain an enormous size, leading to a condition called elephantiasis neuromatosa. Among other symptoms peculiar to Recklinghausen's disease are: patches of brownish pigmentation of the skin, nevi, and loss of intellectual power, with difficulty in speaking.

In *lesions of the spinal nerves* the table on pages 964 and 965 (Hutchison and Rainy) showing the muscles innervated by definite nerves is of value in diagnosis.

THE CEREBRAL NERVES.

Reference to Figs. 167, 168, taken from Butler ("Diagnostics of Internal Medicine"), shows respectively the location of the cranial nerves at the base of the brain and their points of exit from the skull.

Olfactory Nerve.—The nerves arising from the olfactory bulbs are distributed to the nasal mucosa (upper part of nasal septum and the superior and middle turbinates). Affections of this nerve are expressed by the following disturbances of the sense of smell.

1. *Parosmia* refers to subjective sensations which have no objective reality and are hallucinations found in the insane. Unpleasant odors may constitute the aura of an epileptic paroxysm.

2. *Hyperosmia* is a hyperesthesia of the sense of smell, which is often so acute that the hysterical or neurasthenic patient is able, like the dog, to distinguish individuals by the odor.

3. *Anosmia*, or the loss of the sense of smell, is usually caused by local diseases of the nasal mucosa. Among the central causes are: lesions of the bulbs or tracts (caries, tumor, meningitis) and of the olfactory center (uncinate convolution). In testing the sense of smell pungent substances like ammonia which act on the fifth nerve must not be used. The essential oils are usually employed. In the norm the perception of an odor is lost in about three or four minutes, but it is restored after a rest of one minute. The olfactometer, simplified by Onodi and Reuter, may also be employed for investigating the olfactory nerve. If anosmia is caused by nasal obstruction, the sense of smell is often temporarily restored by the local application of a mixture of adrenalin and cocain.

Optic Nerve.—An examination of the fundus of the eye is of the greatest importance in diagnosis. The demonstration of a *retinitis* may first direct attention to a larvated leukemia, syphilis, Bright's disease, or a grave form of anemia. In fact, the retina is frequently involved in many general affections.

Field of Vision.—This may be tested by having the patient sit opposite the physician with his left eye closed while the right eye of the examiner is closed. The right eye of the patient is now

PLATE XXIII.

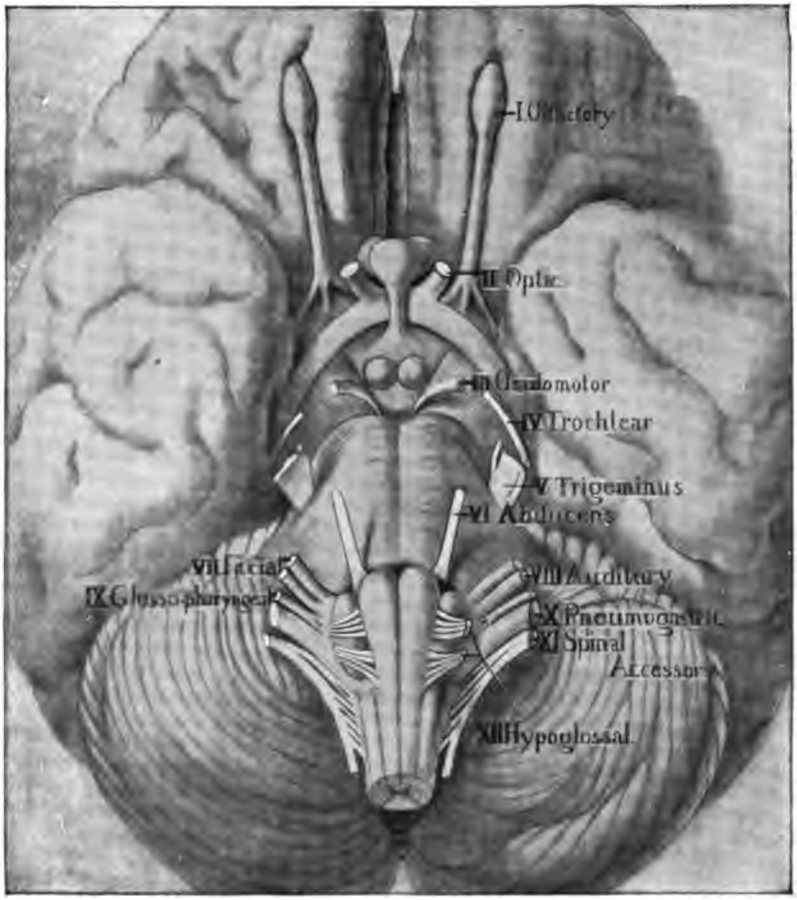


Fig. 167.—The base of the brain. (From Butler, with kind permission of D. Appleton & Co., New York.)

PLATE XXIV.

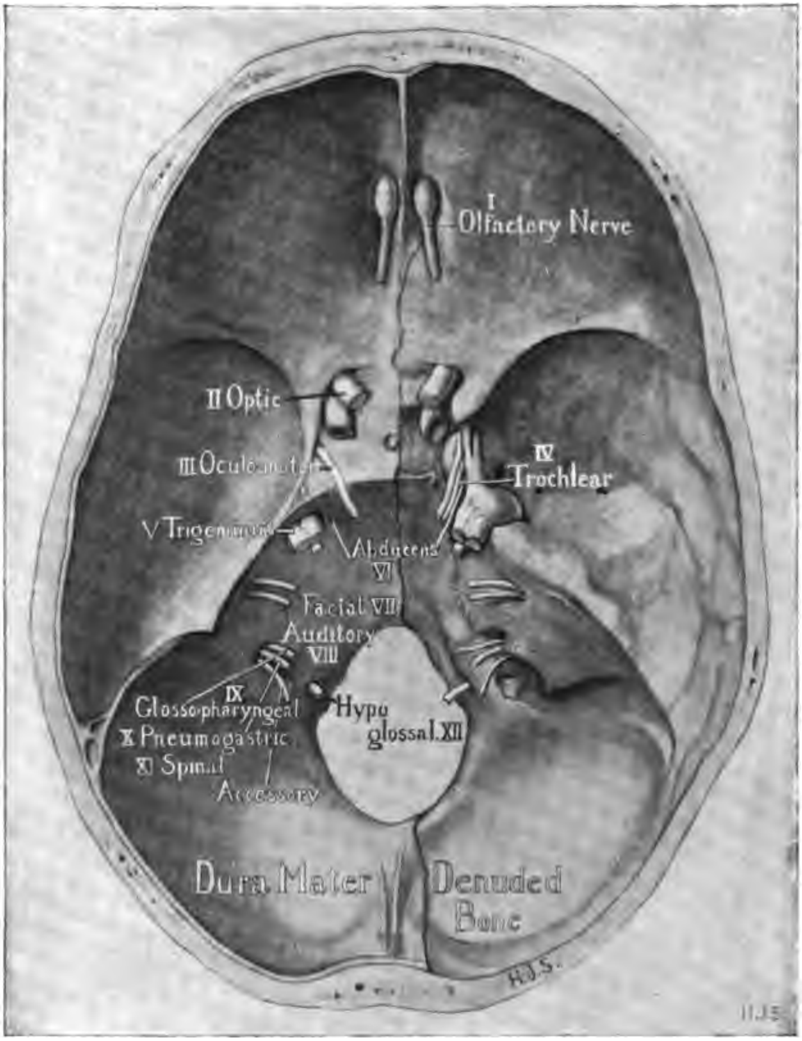


Fig. 168.—The points of exit from the skull of the cranial nerves. (From Butler, with kind permission of D. Appleton & Co., New York.)

fixed upon the examiner's left eye. If the examiner now moves his finger in a frontal plane half-way between the two eyes, from the periphery into the field of vision, he can compare the field of the patient with his own. The blackboard test gives a fairly correct graphic representation of the field of vision. The patient is seated about one foot from a blackboard upon which a cross is marked on which the patient fixes the eye to be tested. A piece of chalk is now moved gradually from the periphery toward the center and the patient indicates when he has observed it in various directions. By uniting the several points marked on the board, the field is obtained. In concentric contraction the field is contracted in all directions and central vision may alone remain. When one-half of the field is absent, it is known as hemianopsia. A *scotoma* is a defect within the visual field, and this blind or partially blind area may be central or peripheral.

Visual Color Fields.—In examining the color sense, small squares of colored paper attached to the end of a rod may be moved from the periphery toward the center, as in the blackboard test. White objects are first perceived, then blue, red, and green (Fig. 169).

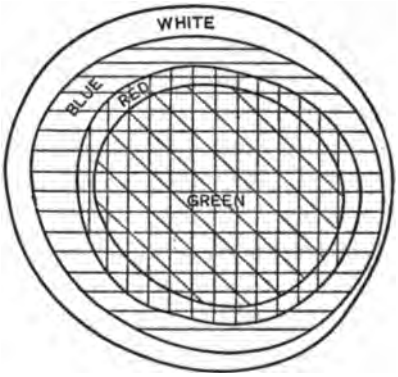


Fig. 169.—Visual color field of right eye.

Amblyopia signifies a reduction in the acuteness of vision unaccompanied by visible changes in the eye, and when the blindness is absolute, it is called amaurosis.

Many forms of partial or total blindness are usually of functional origin and of temporary duration. In *toxic amaurosis* the poisons (quinin, salicylates, lead, alcohol, etc.) probably act on the centers and not on the retina. Among the other common causes of functional disturbances of vision are hysteria, alcohol, and tobacco.

In *hysterical amblyopia* the field of vision is contracted concentrically for white and colors, and as the retina is rapidly exhausted, this limitation becomes more pronounced with each succeeding test. The color fields have not the same relative areas and they may be larger than that for white with order reversed, so that green is the largest, red next, and blue the smallest. Scotoma or hemianopsia may be present. A central scotoma for red or green is a common manifestation in tobacco amblyopia.

Optic Neuritis.—The ophthalmoscopic sign of this affliction is the choked disc: the papilla is large and projecting, whitish or grayish in color, and often shows white spots and hemorrhages. The retinal arteries are thin and the veins distended and tortuous, and the surrounding retina is edematous and congested. The choked disc may be present without visual disturbances. Bilateral optic neuritis is present is many intracranial diseases, notably tumor and meningitis.

Optic Atrophy.—This condition is either primary (spinal diseases) or secondary (pressure on the chiasma or the nerves) from cerebral diseases. Loss of vision is the prominent symptom.

Visual Paths.—Reference to Fig. 170 will aid in the elucidation of the following lesions of the visual paths extending from the retinal expansion to the cortex of the brain: (1) A lesion of the optic nerve results in complete blindness of the corresponding eye. (2) A lesion of the optic chiasm causes temporal hemianopsia when only the central part is implicated, or nasal hemianopsia when the lesion involves the lateral region of each chiasm. (3) A lesion located between the chiasm and the lateral geniculate body causes lateral hemianopsia. (4) If the lesion is located between the geniculate bodies and cerebral cortex, lateral hemianopsia results. (5) Lateral hemianopsia results in lesions of the cuneus. (6) Mind-blindness results in lesions of the angular gyrus.

Having determined blindness of one-half the visual field (hemianopsia) by means of the hemiopic pupillary reaction of Wernicke, which is difficult of application, one may determine whether a lesion causing homonymous hemianopsia is located behind or in front of the primary optic ganglia.

Whereas hemianopsia is present, as a rule, in organic brain disease, it has been noted as a functional affection in migraine, hysteria, and gout.

PLATE XXV

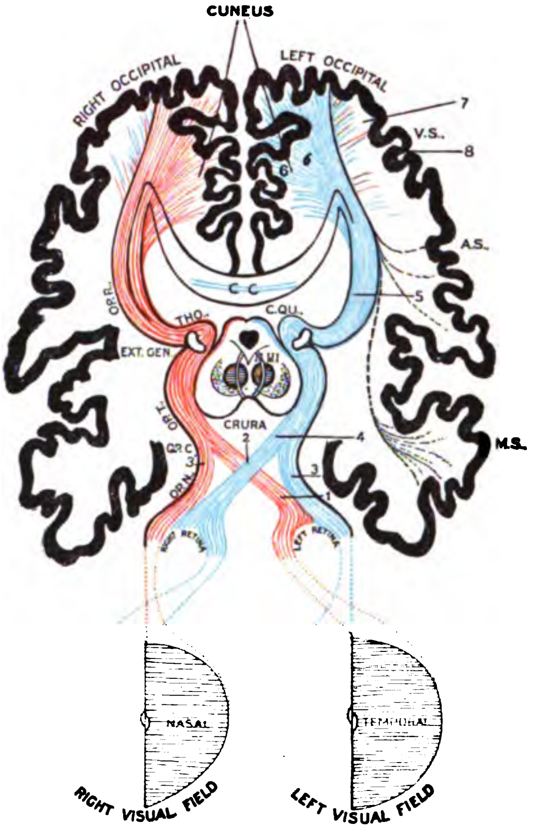


Fig. 170.—The visual paths (Osler, modified from Vialet). OP.N., Optic nerve; OP.C., the optic chiasm; OP.T., the optic tract; OP.R., optic radiations; EXT. GEN., geniculate body (external); THO., optic thalamus; C.QU., corpora quadrigemina; C.C., corpus callosum; V.S., the visual center of speech; A.S., the auditory speech center; M.S, the motor speech center. A lesion located at 1 results in blindness of that eye; at 2, in bitemporal hemianopia; at 3, in nasal hemianopia. Symmetrical lesions at 3 and 3′ result in binasal hemianopia; at 4, in bilateral hemianopia with hemianopic pupillary inaction; at 5 or 6, in bilateral hemianopia with normal pupillary reflexes; at 7, in amblyopia (usually of the opposite eye); and at 8, in word-blindness on the left side.

Motor Nerves of the Eyeball.—

NERVE.	MUSCLES.
Motor oculi (third cranial nerve).	Sphincter iridis. Ciliary muscles. Levator palpebræ superioris. Rectus internus. Rectus superior and rectus inferior.
Patheticus (fourth cranial nerve).	Obliquus superior and obliquus inferior.
Abducens (sixth cranial nerve).	Rectus externus.

Motor Oculi.—When this nerve is completely paralyzed, all the muscles are involved except the superior oblique and external rectus. The latter muscles not being involved, there is some movement of the eye outward, downward, and inward. Involvement of the levator palpebræ produces drooping of the upper eyelid (ptosis). The pupil is dilated and fails to react to light and accommodation, and there is external strabismus. When paralysis of the nerve is incomplete, some of the muscles are uninvolved. The oculomotor nerve may be involved at its nuclear origin, as in ophthalmoplegia; it may be compressed (meningitis, gumma, tumors), or it may be involved as a neuritis in tabes and diphtheria. A form of recurring oculomotor paralysis has been observed, especially in women, associated with cephalic pains.

Ptosis.—Drooping of the upper eyelid may occur alone or associated with paralysis of the oculomotor nerve. It may be congenital or acquired. Hysterical ptosis is bilateral and associated with hysterical symptoms. Transient double ptosis may occur in anemic and neurotic women, and after the use of conium or gelsemium. A pseudo-ptosis dependent on an affection of the sympathetic nerve is associated with vasomotor symptoms (heat, redness and edema of the skin), contraction of the pupil, and a slight recession of the eyeball on the same side. Bilateral ptosis also occurs in idiopathic muscular atrophy when the muscles of the face are involved.

Cycloplegia.—This refers to a paralysis of the ciliary muscle causing loss of the power of accommodation. Distant vision is usually intact, but the subject experiences difficulty in recognizing near objects. Cycloplegia is observed in tabes and diphtheria.

Iridoplegia.—This term refers to a paralysis of the iris. The movements of the pupil are contraction and dilatation. The contracting muscular fibers (sphincter pupillæ) are supplied by the third nerve, whereas the dilating fibers are supplied by the sympathetic. Contraction of the pupil occurs by stimulation of the oculomotorius and by paralysis of the sympathetic. Dilatation of the pupil results from paralysis of the oculomotorius or stimulation of the sympathetic. Contraction of the pupil occurs upon exposure to light, with accommodation and with convergence. The dilatation reflex may be elicited by shading the eye, looking at a distant object, or by scratching the skin of the neck (sensory reflex). The Argyll-Robertson pupil is a reflex iridoplegia observed in locomotor ataxia; the pupil contracts with accommodation and convergence, but does not react to light. Anisocoria refers to an inequality of the pupils observed in tabes, paresis, and even in health.

Nystagmus.—This refers to a clonic rhythmic spasm of the ocular muscles. The movements of both eyeballs are involuntary, rapid or slow, from side to side, vertical or rotary. Nystagmus may be accentuated if the patient is directed to observe an object held either to one or the other side. Nystagmus may be congenital as a result of some ocular defect and in albinos. It is also present in many neuroses. In "miner's nystagmus" there is an irritable weakness of the ocular muscles, observed in coal miners who are forced to strain the muscles by looking obliquely upward while lying upon the side. Nystagmus is also a symptom in disseminated sclerosis, Friedreich's ataxia, tabes, meningitis, and in intracerebral tumors.

Patheticus.—Paralysis of the superior oblique muscle causes a defective downward and inward movement of the eyeball. When the patient looks down, there is double vision.

Abducens.—Paralysis of this nerve, which is not uncommon owing to its long course and exposed position, causes internal strabismus, and the eye cannot be turned outward, and when the patient looks toward the paralyzed side, there is diplopia.

Ocular Paralyses.—Among other signs of disturbances of ocular mobility are: (1) Limitation of movement; (2) strabismus; (3) secondary deviation; (4) erroneous projection; (5) double vision.

Limitation of Movement: When the head of the patient is fixed and the eye is made to follow the examiner's finger in various directions, it will be noted that the movement of the eye is limited in the direction of action of the paralyzed muscle. Thus, if the paralysis involves the external rectus, the eyeball cannot be moved outward.

Strabismus: When the eyes are turned in the direction of the paralyzed muscle, the sound eye will be properly directed, but the affected eye will not move and will squint (paralytic squint). If the eyes are turned in a direction which does not require the action of the paralyzed muscle, there will be no squint. The deflection of the squinting eye is always in a direction opposite to the normal action of the paralyzed muscle and is referred to as the primary deviation.

Secondary Deviation: If while the patient is looking at an object and the second eye is covered, so that only the affected eye fixes the object, the sound eye is moved still further in the same direction, a condition which is known as secondary deviation. The latter is based upon the fact that the strong impulse of innervation necessary to fix the paralyzed eye is transmitted to the associated muscle of the sound eye, resulting in an overaction of this muscle, causing increased contraction. In every variety of ocular paralysis there is a characteristic position of the head with a view of correcting diplopia. The head is usually directed toward the side of the paralyzed muscle.

Erroneous Projection: Our judgment of the relation of external objects to each other is based on the relation of their images on the retina; but their relation to our own body is based upon a position of the eyeballs of which we are cognizant by the innervation given to the ocular muscles. The paralyzed eye does not see objects in their correct location, and the movements of the eye not corresponding to the effort made in innervating, it leads to an erroneous judgment concerning the position of the body with reference to surrounding objects. The patient has an erroneous idea of the position of the eye, which is easily demonstrated by having him close his sound eye and then direct him to point quickly at an object in front of him: the finger will be pointed to the side of the object corresponding to the paralyzed muscle. The equilibrium of the body is largely dependent upon the relation of external objects to it by the action of the ocular muscles, and if the perception is erroneous, dizziness (ocular vertigo) results. In testing for ocular vertigo, the sound eye must be closed, and by closing the affected eye the vertigo disappears.

Double Vision (*Diplopia*): In this condition double vision occurs because the visual axes do not correspond. The image in the sound eye is called the true, and in the paralyzed eye the false, image.

Ophthalmoplegia.—This refers to a chronic progressive paralysis of the ocular muscles. In ophthalmoplegia externa there is a complete paralysis of the external ocular muscles, usually caused by a degeneration in the nuclei of the nerves. The levator muscles of the eyelids and the superior recti are primarily affected, and then the other muscles become involved. The eyelids droop, the eyeballs are fixed, and protrude slightly. The condition may last for years, and has been found to be associated with tabes, paresis, and progressive muscular atrophy. While the affection is usually organic, a functional form has been reported. Ophthalmoplegia interna is a progressive paralysis of the internal ocular muscles resulting in iridoplegia and cycloplegia. When combined with the external form (and this is usual), it is known as total ophthalmoplegia.

FUNCTIONAL TESTS OF THE EYE.

Hansell correctly observes: "We have not yet advanced to that stage when we study diseases of the body in relation to ocular defects, and fail to consider diseases of the eye in relation to general diseases."

No one can deny that many functional neuroses are caused, or at least exaggerated, by errors of refraction and insufficiencies of the ocular muscles. It is equally true that effect has been confounded with cause, and if a defective eye can provoke constitutional anomalies, the latter can instigate ocular anomalies. Helmholtz observed: "Nature seems to have packed this organ (eye) with mistakes, as if with the avowed purpose of destroying any possible foundation for the theory that organs are adapted to their environment."

An ocular defect is perhaps the most constant peripheral irritant in the etiology of headache and many neuralgias. I will make no attempt to describe the manifold methods employed for testing the sight, but will content myself by referring to a few simple procedures which will enable one to demonstrate defects of vision.

Accommodation.—The power of accommodation refers to the unconscious ability of changing the focal conditions of the eye—a function which is executed by the ciliary muscle and the crystalline lens. The latter is practically a biconvex lens, and the sharper its curve, the nearer is its focus. In looking at a distance the eye is at rest, but when a near point is observed the ciliary muscle in the ciliary body (Fig. 171) causes the crystalline lens to assume a greater

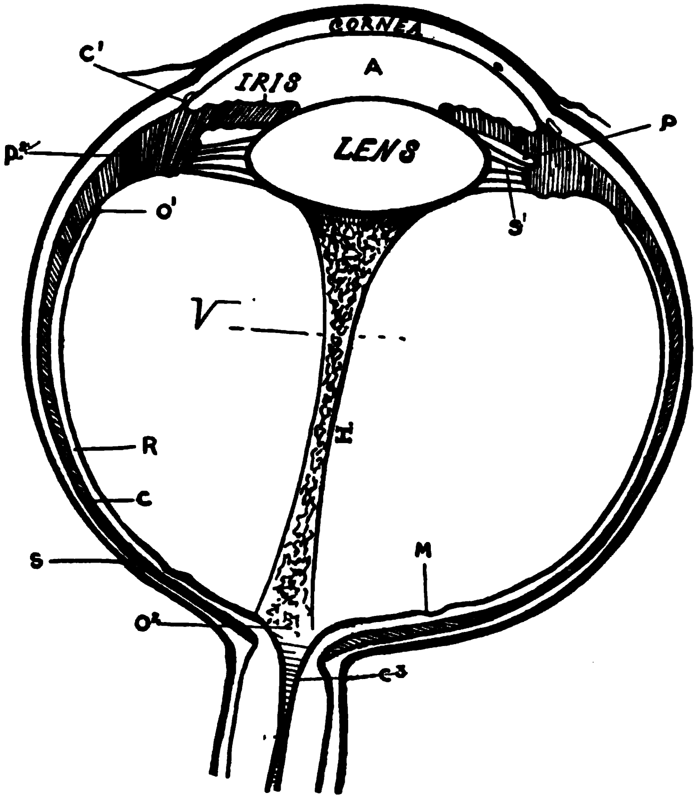


Fig. 171.—Horizontal section of the eyeball. A, Anterior chamber; C, choroid; C^1, canal of Schlemm; C^2, ciliary body; C^3, central artery of retina; H, hyaloid canal; M, macula; O^1, ora serrata; O^2, optic disk; P, posterior chamber; R, retina; S, sclera; S^1, suspensory ligament; V, vitreous.

convexity. Accommodation is associated with contraction of the pupil and convergence of the visual lines.

Distant Vision.—This may be determined by means of charts (which may be obtained from opticians) on which are square-shaped letters diminishing in size from above downward. The figures at the foot of each series of letters signify the distance at which they can be read by a normal eye. Thus, if the patient can only see letters at 6 meters which should be read at 60, the vision (V.) is $\frac{6}{60}$, or V. = $\frac{6}{60}$. Normal vision would be expressed as V. = $\frac{6}{6}$. If the distance on the chart is expressed in feet, the numerator corresponds to the number of feet of the patient from the chart, and the denominator to the number indicating the distance at which the smallest letters should be read by a normal eye (Fig. 172).

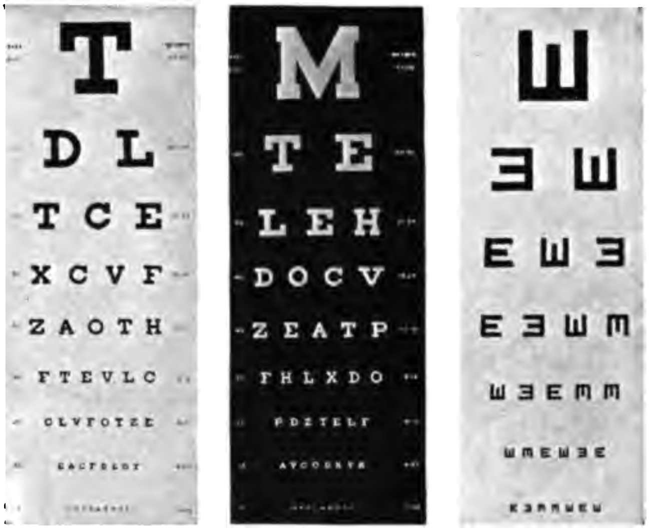
Near Vision.—The acuteness of near vision is dependent on the power of accommodation. To test this vision Jaeger's test-types are employed (Fig. 173). With his back to the light and the page properly illuminated, the patient reads (each eye is tested separately) the different test-types. Near vision is expressed by J., succeeded by the number corresponding to the smallest print which can be read. Thus J. 4, would signify that the patient can read the third paragraph.

In *myopia*, which is usually caused by a lengthening of the antero-posterior diameter of the eyeball, the usual sign is indistinct vision for distant objects. Near vision is usually undisturbed.

In *hypermetropia* (hyperopia), which is usually caused by a shortening of the antero-posterior diameter of the eyeball, the vision for distant objects is usually good, but the eye is subject to great strain in viewing near objects. The increased accommodative efforts necessary in near work cause eye-strain, or asthenopia. Asthenopia gives rise to headaches and neuralgias and blurring of near vision. Asthenopia is often betrayed by conjunctival congestion, lacrimation, and photophobia. In other words, the latter symptoms occurring without apparent reason suggest some refractive error.

Presbyopia.—This refers to a physiologic change commencing usually after the age of forty years. In this condition the lens has lost its activity, and not reacting to the action of the ciliary muscle, the power of accommodation is diminished. The presbyope notes

PLATE XXVI.


T
D L
T C E
X C V F
Z A O T H
F T E V L C
M
T E
L E H
D O C V
Z E A T P
F H L X D O

A *B* *C*

Fig. 172.—Test types of Snellen. *A*, represents the customary chart; *B*, shows white letters on a black ground; and *C*, a chart for illiterates.

an increasing sensation of effort and fatigue after doing fine work and fine type is obscured. The presbyope requires strong illumination for reading and he holds his book or paper farther away than the usual distance. Distant vision is unaffected. If his error is not corrected, the symptoms of *asthenopia* develop.

Astigmatism.—The usual cause of this condition is a change in the curvature of the cornea so that refraction is not the same in different meridians. There are many varieties of astigmatism. The acuteness of distant and near vision is diminished and symptoms of *asthenopia* are frequent. A simple test for astigmatism is by means of a chart (astigmatic dial), which can also be purchased from any optician. The dial has radiating lines numbered like the face of a clock, and if the patient is unable to see all the lines with equal distinctness, astigmatism is present. Another simple test is by means of the keratoscope (Fig. 175), which consists of a circular disk upon which are alternate white and black rings. The patient, with his back to the light, fixes the center of the disk, and the examiner, looking through an opening in the disk, observes the rings reflected upon the cornea of the patient. No astigmatism is present if the image shows the concentric circles, but when the circles are elliptical or distorted astigmatism exists.

No. 1.

"Engaged in manual occupation of a coarser sort, the laborer has little opportunity either to try or to misuse his organs of vision; his sight, unless attacked by local inflam-

No. 2.

matory diseases or the consequences of constitutional disorders, remains good, though its acuteness lacks that extreme development

No. 3.

which follows abundant use in higher types of occupation. But with the literary worker it is differ-

No. 4.

ent: keeping pace more or less with mental activity, the eye is constantly called upon for

No. 5.

action, in reading for information and reference on the one hand, in recording the

No. 6.

fruits of such occupation on the other. Observation has shown that deteriora-

No. 7.

tion in eyesight and changes in the form, and hence in the dioptric

Fig. 173.—Test types of Jaeger for near vision. (By kind permission of Dr. Chas. May, Wm. Wood & Co., New York.)

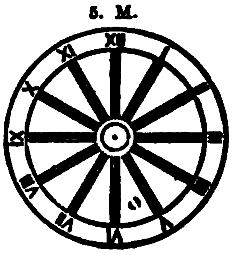
Asthenopia.—This term signifies eye-strain which is caused by fatigue of the ciliary muscle or extraocular muscles. The following varieties of the affection are recognized:

1. *Accommodative asthenopia* is caused by fatigue of the ciliary muscle owing to excessive action of the latter in overcoming errors of refraction, as in hypermetropia, astigmatism, and presbyopia.

2. *Neurasthenic asthenopia* is observed in neurotics with or without errors of refraction. Glasses give no relief because the condition is but an ocular expression of asthenia. Correction of the general health is the only way of relieving the condition.

3. *Muscular asthenopia* is caused by *heterophoria.*

Symptoms.—All forms of asthenopia have symptoms in common, viz., pain around the eyes and in various parts of the head which is aggravated by excessive employment of the eyes, especially when used at night for near work; dimness and confusion of vision, drowsiness, vertigo, diplopia and many neuroses; lacrimation, photophobia, and burning and itching of the lids.



No. 174.—Astigmatic dial.

Heterophoria.—This signifies an insufficiency or a lack of balance of the ocular muscles. The eyes show a tendency to deviate, but owing to the use of extraordinary innervation, the eyes are forced into simultaneous fixation of an object so as to secure binocular vision and prevent diplopia. Perfect muscular balance is known as orthophoria. Deviation of the eye outward is called exophoria; esophoria, when the deviation is inward; hyperphoria, when the deviation is upward. Among the common causes of this imperfect muscle-balance are errors of refraction and diminished tone of all the muscles, in which lack of tone the ocular muscles participate. The symptoms of this condition are asthenopic.

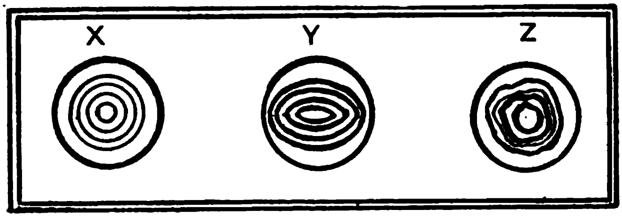


Fig. 175.—Keratoscope: *X*, Corneal reflection of Placido's disk in emmetropia; *Y*, corneal reflection in regular astigmatism, and *Z*, the reflection in irregular astigmatism.

Tests for Heterophoria: Among the different tests only the following will be mentioned:

1. In the fixation test the patient is directed to fix his attention on a small object which is held in the median line on a level with his eyes; the object is then brought slowly to within two inches of the patient's nose. If there is any weakness of the interni (exophoria), one of the eyes will be directed outward before the convergence point is attained.

2. In the cover test an object is viewed by the patient at a distance of 20 feet. The object is placed in the median line on a level with the eyes. The examiner places a card over one and then the other eye alternately, and observes the position and movement of the eye at the time the card is removed. If after uncovering the right eye and placing the card over the left eye the right eye deviates inward in order to fix the object, there was an outward deviation (exophoria) when that organ was covered, and if an uncovered eye deviates outward, esophoria is present.

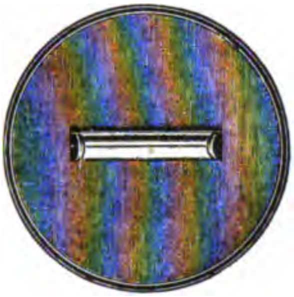


Fig. 176.—The Maddox rod.

3. The Maddox rod is a glass rod fixed in a disk of hard rubber so that it can be conveniently fitted into a trial frame (Fig. 176). If this rod is placed in a horizontal position before the right eye, it converts the image of the candle-flame into a long streak of vertical light (Fig. 177, I), and there is no desire to unite it with the image of the other eye, provided there is orthophoria or muscular sufficiency. If the line of light appears to the left of the flame, there is exophoria; and to the right of the flame, esophoria (Fig. 177, II, III). If the rod is placed in a vertical position before the right eye, converting the image of this eye into a horizontal line of light which will pass through the image of the left eye (Fig. 178, I), muscular sufficiency, or orthophoria, is present. If the line of light is seen below the image of the flame with the left eye, right hyperphoria is present; and if above, left hyperphoria. There are simple ophthalmoscopic signs which are of value to those who can use the ophthal-

moscope. By indirect ophthalmoscopy with a concave mirror and focusing glass, the disk is larger than usual, and diminishes on withdrawing the glass from the eye when hyperopia is present. In myopia the disk is smaller than usual and enlarges on withdrawing the glass; and in astigmatism the disk is oblong and alters in shape on withdrawing the focusing glass.

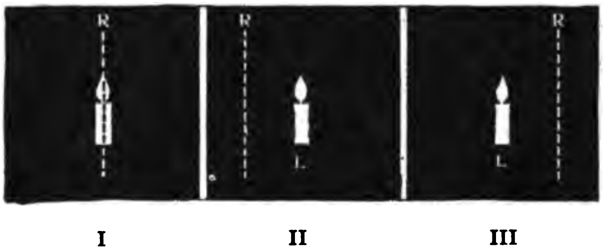


Fig. 177.—I, The Maddox rod test in orthophoria; II, in exophoria, and III, in esophoria.

Trigeminus.—The motor branch of the fifth nerve supplies the muscles of mastication, and the latter are tested by having the patient bite upon some object (wood or cork) during the time that the physician holds the jaw. In paralysis of the motor portion of the nerve one may also detect the insufficiency of the masticatory muscles by placing the finger on the temporal and masseter muscles and noting the feebleness of their contraction when the jaw is closed. Spasm of the masticatory muscles may be tonic (trismus or lockjaw), as in tetanus, tetany, hysteria, and in organic disease caused by irritation near the motor nucleus of this nerve; the spasm

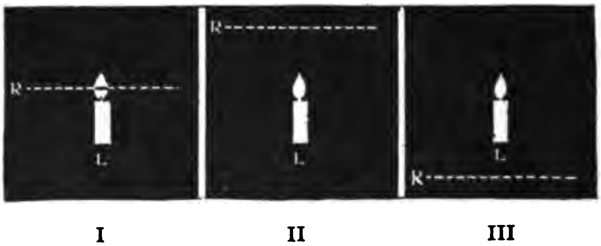


Fig. 178.—I, The Maddox rod test in orthophoria; II, in left hyperphoria, and III, in right hyperphoria.

is clonic and is observed in chorea and when the teeth chatter. The sensory portion of the trigeminus supplies the skin of the face, mucous membranes of the mouth and nose, conjunctiva and cornea of the same side. This nerve is also concerned in taste (*chorda tympani*). In disease of the sensory portion of this nerve anesthesia is present in the parts supplied; owing to dryness of the nasal mucosa, there are disturbances of the sense of smell and the sense of taste is partially or completely lost in the anterior two-thirds of the tongue. In determining the sense of taste the tongue is protruded and kept so during the time that the various substances are placed upon each side of the median line of the tongue. For testing the perception of bitter sensations, a solution of quinin is used; for sweet, sugar; for acid, vinegar; and for salt, sodium chlorid. Ageusia signifies loss or impairment of the sense of taste, and parageusia,* perversion of the sense of taste. Neuralgia of this nerve is known as trigeminal neuralgia, or *tic douloureux*. The trigeminus may be involved in diseases of the pons (hemorrhage or sclerosis), affections at the base of the brain (fracture, caries of the bone, and meningitis,) and from pressure by tumors, and neuritis.

Facial Nerve.—Paralysis of the seventh nerve may be caused by lesions of the cortex (supranuclear palsy), lesions of the nucleus (nuclear paralysis), and involvement of the nerve-trunk. To test facial paralysis, direct the patient to close the eyes tightly and raise the upper lip to show the teeth; in complete palsy the eye cannot be closed, the eyeball rolls upward, and the palsied side of the face is in marked contrast with the other side. The patient may also be directed to wrinkle the forehead, to laugh, to whistle, to pucker the lips, or to pronounce labial sounds. In bilateral facial palsy the expression of the face is entirely lost, and when the muscles are in action, the mask-like appearance is accentuated. The latter condition, known as facial diplegia, is usually caused by affections at the base of the brain. It is important to distinguish the central from the peripheral forms of facial paralysis.

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* Parageusia may result from the loss of epithelium in certain areas on the surface of the tongue. Such areas may be demonstrated by painting the surface of the tongue with a solution of nitrate of silver (30 grains to the ounce); the red papillæ in the denuded areas will stand out prominently against a white background. Protecting the areas in question with a stronger solution will cure the condition.

Central Facial Paralysis.	Peripheral Facial Paralysis.
Partial paralysis of the middle and lower branches of the nerve. The upper branch is slightly affected, hence the power of closing the eye and wrinkling the forehead is usually preserved.	All the branches of the nerve are involved, hence the affected side is immobile and it does not participate in any emotional movements. The eye cannot be closed and the forehead cannot be wrinkled.
The tongue, when protruded, deviates toward the paralyzed side.	The tongue does not deviate from the middle line, but appears to do so because the lips are drawn to the sound side. Taking the position of the tongue from the incisor teeth, it will be found to be in the median line.
The electro-contractility of paralyzed nerves and muscles is retained.	The electro-contractility of the nerves and muscles is always changed (*vide infra*).
There are other symptoms of an intracranial lesion, viz., headache, vertigo, delirium, paralyses of the extremities, etc.	Cephalic symptoms are absent.
Caused usually by intracranial hemorrhage, embolism or thrombosis with softening, and less frequently by abscesses and tumors.	The most frequent cause is exposure to cold, resulting in neuritis of the nerve (Bell's palsy).

Location of the Lesion in Peripheral Facial Paralysis.—If the lesion is located above 5 (Fig. 179), all the facial muscles, uvula, and velum palati are involved, and there are disturbances of hearing, but not of gustation, owing to the fact that the chorda tympani (*CHT*) leaves the facial nerve between 2 and 3 to join the lingual branch of the trigeminus. If the lesion is located between the ganglion geniculatum (*gg*) and the point at which the nerve to the stapedius muscle (*stp*) is given off, there will be a paralysis of all the facial muscles plus disturbances of hearing and taste (anterior two-thirds of tongue). If the lesion is situated between the origin of the stapedius nerve (*stp*) and the chorda tympani (*cht*), the symptoms previously mentioned are present minus disturbances of hearing.

Electrical Reaction.—According to the electrical reaction three forms of peripheral facial paralysis are recognized:

1. A mild form; the electrical contractility of the affected nerve and muscles for the faradic and constant current remains normal during the palsy or it may be diminished without qualitative changes of reaction. These mild forms usually recover in about three weeks.

2. A severe form, in which the faradic and galvanic excitability of the nerves and the faradic excitability of the muscles are lost, and

if the galvanic excitability of the muscles is quantitatively increased and qualitatively changed (reaction of degeneration), the prognosis is not good, and recovery may not occur at all, or many months may elapse before the mobility of the muscles is restored.

3. A medium form, in which the faradic and galvanic excitability of the nerve is only diminished and the muscles show sluggish contraction and an altered formula to the galvanic current (partial reaction of degeneration); the prognosis is decidedly better than in the severe form and recovery may be prognosticated in from one to two months.

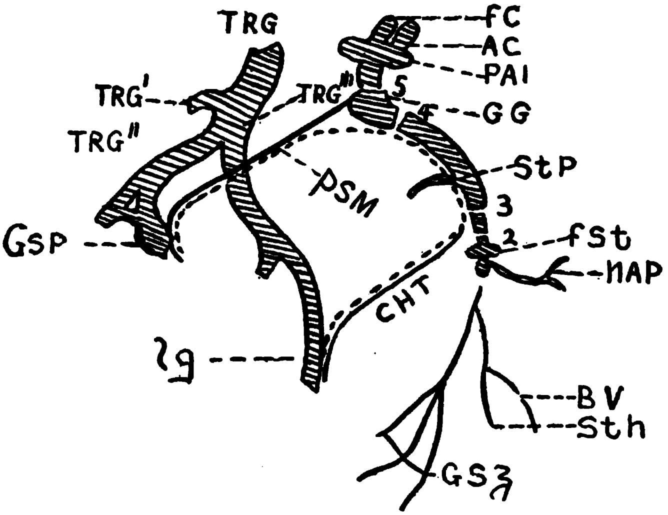

Fig. 179.—Schematic representation of the ramifications of the facial nerve: *FC*, trunk of facial nerve; *AC*, trunk of acoustic nerve; *PAI*, internal auditory foramen; *GG*, ganglion geniculatum; *PSM*, nervus petrosus superficialis major; *Stp*, nervus stapedius; *CHT*, chorda tympani; *FSt*, styloid foramen; *NAP*, posterior auricular nerve; *BV* and *Sth*, nerves to the digastric and stylohyoid muscles; *TRG*, *TRG′*, *TRG″*, *TRG‴*, trunk and branches of the trigeminus; *Gsp*, sphenopalatine ganglion; *lg*, lingual nerve (Eichhorst).

Auditory Nerve.—This nerve is made up of two roots: (1) The cochlear, which is connected with the organ of Corti and is the nerve of hearing; and (2) the vestibular root, which is connected with the vestibule and semicircular canals and is concerned in the maintenance of equilibrium. The most usual lesions of the auditory nerve are located in the internal ear, and symptoms consist of hyperesthesia and nervous deafness.

Hyperesthesia and Irritation.—In hyperesthesia (hyperacusis) noises are heard with unusual intensity and sounds inaudible to others are perceived by the subject. This condition must not be confounded with dysesthesia, in which all noises are unpleasant to nervous individuals. Subjective sounds are heard in the ear (*tinnitus aurium*). Among the causes of tinnitus are: affections of the ear, anemias, neurasthenia, arteriosclerosis, toxemias (gout, nephritis), hysteria, etc. In some instances a constant clicking may be heard by the physician, and is supposed to be caused by a clonic spasm of the muscles connected with the Eustachian tube or of the levator palati.

The character of the sounds in the ear may furnish a clue to their cause:

1. Sounds of a bubbling, singing, or whistling character are probably caused by a catarrhal affection of the middle ear or Eustachian tube or result from some irritation in the external meatus.
2. Constant rushing sounds may be caused by labyrinthine diseases.
3. If the sounds correspond to a systolic *bruit* and are synchronous with the heart-beat and are arrested by carotid compression, they are probably vasomotor symptoms observed in neurasthenia and anemia. At times auscultation may reveal a systolic murmur.

Nervous Deafness.—The ordinary forms of deafness are caused by conditions of the ear which fail to transmit vibrations to the end-organ and the nerve is not involved. If the ticking of a watch or the vibrations of a tuning-fork are heard with difficulty when placed at varying distances from the ear (aërial conduction), but are more distinctly audible by bone conduction, *i. e.*, by placing the watch or fork against the skull or mastoid process, the deafness is dependent on some defect in the auditory mechanism for conveying sounds. In nervous deafness the nerve is involved, and sounds which fail to be heard by aërial, are equally inaudible by bone conduction.

Deafness is often simulated, and hysterical deafness may be complete. To detect malingering, the hearing of each ear should be tested during the time the eyes of the patient are closed, so that he has no guide to estimate the distance from which the sound comes. A simple method for detecting simulation of unilateral deafness is by means of a binaural stethoscope. If a patient says he hears nothing in the left ear, a wooden plug is inserted into the right rubber tube (unknown to the patient), so that the right tube cannot conduct sound. After the stethoscope is adjusted into the ears of the patient the latter is directed to repeat the words whispered into the bell of the instrument. The patient will repeat the words without hesitation. Take the tube containing the plug out of the right ear and firmly close the latter by pressure on the tragus. The stethoscope is now only in contact with the left ear, and the malingerer will affirm that whispered words are inaudible, for he is aware that the tube through which he supposed he had before heard is no longer in contact with his good ear (right ear). Dr. David Coggin is the originator of this very ingenious method.

Lesions of the vestibular branch of the auditory nerve are associated with the symptoms of Ménière's disease (page 936).

Glosso-pharyngeal Nerve.—The ninth nerve supplies the muscles of the pharynx, pharyngeal constrictors, and the stylopharyngeus muscle with motor fibers and sends sensory fibers to the upper part of the pharynx. It is also concerned in the sense of taste (posterior third of the tongue). This nerve is rarely involved alone, and owing to its many communications with other nerves its definite pathology is obscure.

Pneumogastric Nerve.—The nucleus of this nerve may be involved in the medulla oblongata by softening, hemorrhage, or degeneration, but usually in association with the spinal accessory and hypoglossal, thus constituting the condition known as bulbar paralysis. The trunk of the nerve may be compressed by tumors and meningeal exudations or it may be implicated by neuritis or neuromata. Lesions of the nerve-trunk result either in irritative, but more commonly in paralytic symptoms. In paralysis there is bradypnea and tachycardia. Partial symptoms of paralysis are encountered in connection with lesions of the branches of the pneumogastric. The pneumogastric or vagus nerve supplies the pharynx, larynx, lungs, heart, esophagus, and stomach.

1. The *pharyngeal* branches innervate the muscles and mucosa of the pharynx. If the symptoms are irritative, there is spasm of the pharynx. This spasm constitutes the *globus hystericus* in hysteria, which gives rise to the sensation of a ball in the throat.

This spasm is also a prominent symptom in hydrophobia and in the so-called forms of pseudo-hydrophobia. In paralysis there is difficulty in swallowing and food may pass into the larynx or into the posterior nares when the soft palate is implicated.

2. The *laryngeal* branches are the superior laryngeal, which supplies the laryngeal mucosa above the cords and the cricothyroid muscle, and the recurrent laryngeal nerve, which winds around the arch of the aorta on the left side and around the subclavian artery on the right side and supplies the laryngeal mucosa below the cords and all the laryngeal muscles except the cricothyroid and the epiglottidean. Involvement of the laryngeal branches results in spasm, paralysis, and anesthesia. *Laryngismus stridulus*, common in children, is a spasm of the laryngeal muscles, and the laryngeal crises of tabes, tetany, and hysteria are of the same character. Eustace Smith,[336] referring to laryngismus in infants, remarks that without exception one finds extreme nasal obstruction due either to adenoid overgrowth or post-nasal catarrh. In catarrh a few drops of a resorcin solution (1 or 2 grains to the ounce of normal saline) instilled into the nostrils several times a day as the infant lies on the lap of the nurse will arrest the crowing, but no material improvement can be expected if adenoids are present until the nasopharynx is scraped. The laryngeal palsies are only correctly diagnosed by aid of the laryngoscope. The following table presents a summary of the laryngeal paralyses (Gowers):

Symptoms.	Signs.	Lesion.
(*a*) No voice; no cough; stridor only on deep inspiration.	Both cords moderately abducted and motionless.	Total bilateral palsy.
(*b*) Voice low-pitched and hoarse; no cough; stridor absent or slight on breathing.	One cord moderately abducted and motionless, the other moving freely and even beyond the middle line in phonation.	Total unilateral palsy.
(*c*) Voice little changed; cough normal; inspiration difficult and long, with loud stridor.	Both cords near together, and during inspiration not separated, but even drawn nearer together.	Total abductor palsy.
(*d*) Symptoms inconclusive; little affection of the voice or cough.	One cord near the middle line, not moving during inspiration; the other normal.	Unilateral abductor palsy.
(*e*) No voice; perfect cough; no stridor nor dyspnea.	Cords normal in position and moving normally in respiration, but not brought together on an attempt at phonation.	Adductor palsy.

Anesthesia of the larynx may occur in diphtheritic neuritis, bulbar paralysis, and hysteria.

3. The *cardiac* branches join with branches of the sympathetic nerve to form the cardiac plexus. The vagus supplies the heart with both motor and sensory fibers. The motor branches inhibit and regulate cardiac action (page 750). The sensory fibers are responsible for the various sensations experienced by the patients who suffer from cardiac neuroses.

4. The *pulmonary* branches supply the bronchial musculature (page 500), and it is assumed that the pathology of asthma is in some way associated with lesions of these branches.

5. The *gastric* and *esophageal* branches are associated with gastric and esophageal neuroses.

Spinal Accessory Nerve.—This motor nerve has an internal or accessory portion which joins the vagus and innervates the laryngeal muscles, and a larger or external part which supplies the sternomastoid and trapezius muscles. The portion which joins the vagus constitutes the vago-accessory nerve. The external part (or spinal portion) arises from the cervical spinal cord, and after ascending into the cranial cavity passes out again with one of the cranial nerves. It follows that the nuclei of the external portion may be involved in degeneration of the motor nuclei of the cord, or it may be compressed in the foramen magnum or elsewhere by tumors, vertebral caries, etc. Lesions of the external branch of the accessorius may result in symptoms of spasm or paralysis. *Torticollis*, or wry-neck, may be congenital or spasmodic. The congenital form, also called fixed wry-neck, is usually caused by a shortening of the sternocleidomastoid muscle, which may also be atrophied. The trapezius may also be involved. The condition is associated with facial asymmetry and is probably of central origin. This condition must not be confounded with rupture of the muscle occurring at birth, leaving a local induration or muscle-callus. In the spasmodic form the spasm may be clonic or tonic. In the clonic form there are paroxysmal twitchings of the head, and in the tonic form the head is turned to the opposite side, the chin is raised, whereas the occiput is pulled toward the affected side, constituting the *caput obstipum spasticum*. When the trapezius is implicated, the head is drawn down toward the affected side. In *paralysis* of the external branch the sternomastoid and trapezius muscles are involved.

Hypoglossal Nerve.—This is the motor nerve of the tongue and for the muscles which fix and depress the hyoid bone in mastication and deglutition. *Spasm* of the tongue may be tonic or clonic. In the tonic form the tongue is contracted and rigid, whereas in clonic spasm, observed in many neuroses and in stuttering, the tongue is protruded and retracted or twitches irregularly. There is a spasm of the tongue, not unlike writer's cramp, observed in public speakers on attempting to speak. Clonic spasm is also observed in disseminated sclerosis and paresis. *Tremor* of the tongue is a frequent symptom of chronic alcoholism, paresis, paralysis agitans, and in neurotics. *Paralysis* of the tongue (glossoplegia) may be unilateral or bilateral. In supranuclear disease there is hemiplegia and the tongue is protruded toward the affected side; there is no wasting of the tongue nor change in electrical reaction. In nuclear disease the paralysis is usually bilateral and there is atrophy and the reaction of degeneration. Nuclear disease is observed in bulbar paralysis.* In infranuclear disease only one nerve is affected and wasting and the reaction of degeneration are present.

MUSCULAR SUFFICIENCY.

Physiology.—In the living animal the muscles are more or less stretched and in a condition of tonicity or tonus. Muscular tonus is dependent on the state of the nervous system and a proper supply of healthy blood to the muscles. Fatigue of a muscle is chiefly caused by the accumulation of the waste products of contraction, notably sarcolactic acid. The latter products passing into the circulation also intoxicate the central nervous system and diminish the power of the latter to send out impulses. It follows, then, that fatigue is a local or muscular expression and an evidence of intoxication of the nervous system. An exhausted muscle may recover if let alone, but the recovery may be hastened by passing a stream of blood or salt solution through the blood-vessels of the muscle. Massage of the muscles will also remove the evidence of fatigue, simply because the waste products from the muscles are washed away into the circulation. One may induce fatigue artificially by "feeding" a muscle with a dilute solution of lactic acid, and a watery extract from an exhausted muscle will, when injected into a fresh muscle, cause the latter to lose its energy. A fatigued muscle is acid and alkaline in reaction during repose. Every function of the body is controlled and operated by the nervous system. The latter, which dominates the mind, also controls the action of the muscles. The time during which an individual can sustain a voluntary muscular contraction is determined in part by the endurance of the brain-centers engaged in the act of volition, and in part by the muscles themselves. The moment the brain-centers are exhausted, the muscle-contraction gives way. Volition can be fatigued when exerted in imagination as well as in actual muscle-effort. Thus fatigue is a central as well as a peripheral condition. Weichardt, in 1904, proposed the theory that manifestations of fatigue were produced by a toxin generated in the overexerted organism which is similar to diphtheria, ricin, abrin, and tetanus toxins. For this fatigue toxin an antitoxin could be produced which *in vitro* and *in vivo* would neutralize it.

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* Ferreira[344] employs *apomorphin* subcutaneously for the purpose of recognizing bulbar paralysis in its very earliest stage before the conventional clinical signs may be regarded as trustworthy. In bulbar paralysis, vomiting is provoked with difficulty and even nausea is less pronounced than in the norm. If no vomiting follows the injection, the disease may be regarded as very grave. Thus apomorphin is of prognostic value as well as diagnostic. Apomorphin is equally efficient in the differentiation of the true and false forms of bulbar paralysis.

Wolf-Eisner,[248] in discussing this question, puts forth the idea that athletic training may produce an immunity to this toxin, and thus allow the trained athlete to perform much more work than the untrained.

A fatigue toxin was obtained from animals fatigued by mechanical and experimental means which when inoculated into other animals in small doses produced symptoms of fatigue, drowsiness, and a lessening of activity. The toxin is easily absorbed from mucous surfaces, and so it was administered in the experiments by spreading it on the conjunctiva. Death often follows the administration. A genuine antitoxic immunity was produced by the non-fatal doses.

The fatigue toxin was not found in the blood of animals, but in the muscles, while the blood contained the antitoxin. The toxin is not dialyzable, while the antitoxin can be dialyzed with ease. This difference, the author thinks, accounts for the fact that the antitoxin is found in the blood, while the toxin is not.

The fatigue toxins have the properties of colloidal, high-molecular, albuminous bodies. The author thinks, however, that this may be due to the fact that the toxins cannot be separated from the albuminous bodies, and so appear to be very similar to them.

It has been found that the use of the antitoxin of one animal is harmless to an animal of another species, and that certain conditions, such as are found in neurasthenia, may be due to the lack of antitoxin production. By the breaking down of albumins by electrolysis, toxins can be formed which can also produce an antitoxin. The fatigue toxin is probably of this nature.

Pathology.—It has already been observed that fatigue has its origin in the muscles as well as the nervous system. If one tests the strength of the muscles, say in neurasthenia, by means of the dynamometer, while the muscles may show a diminished response, it is by no means proportionate to the diminished vigor experienced by the patient. Muscular tire is usually expressed by general muscular weakness and lack of endurance. When fatigue symptoms are exaggerated, they become painful, and are described as "aches." Tremor is another symptom of muscular fatigue. Pains in the lumbar region, in the legs, and elsewhere are often caused by an insufficiency of the musculature. All our muscular groups are not equally and symmetrically developed, and many deformities, such as round shoulders, deformed chests, spinal curvatures, etc., bear witness to the truth of the foregoing statement. Strength-tests are of great value in the recognition of muscular asthenia as well as in the prescription of exercise. While moderate voluntary muscular exercise is a valuable means of influencing nutrition, it is equally harmful when carried to excess. Physical overwork drains our capital of nerve force and disturbs the equilibrium of mental and physical health. The law of Edinger embraces the following facts: Increased function, if regularly and gradually increased, leads first of all to increased growth; if carried to excess, however, or if irregular and spasmodic, it leads to waste and degeneration of the tissues concerned. Self-culture includes a training of the physical, moral, and intellectual parts of man. All must be equally and judiciously trained. An exclusive training of the physical part will develop an athlete; of the moral, an enthusiast; of the intellectual, a crank.

One of the most important functions of physical training is developmental or educational, whereby one may command the muscles singly or in groups to operate accurately. If I am permitted to digress for a moment to give expression to my prejudiced conception of many morbid manifestations, I witness muscular tissue in a state of incoördination; uncontrolled by will and subordinated to the vagaries of undisciplined reflex centers, the muscular orgy presents the tableau of muscles gone mad. Practically everywhere throughout the organism where muscle is found, fibers coexist which dilate or contract. When neither function predominates, there are no morbid manifestations; in other words, a normal function is a question of muscular equilibrium. The moment one set of fibers gains the ascendency over its antagonist, the symptomatic picture is made up of spasm or paralysis. If the crazy muscles in locomotor ataxia can be re-educated after the method of Frenkel,[343] one need not despair in disciplining the unruly muscles of many neuroses. The application of this principle in asthma (page 510) has given me excellent results. Stethographic tracings of the chest in the latter disease always reveal some anomaly in the respiratory rhythm, and insufficiency of the muscles concerned in expiration or the insufficiency of the latter is only apparent, due to the augmented tonus of the muscles concerned in inspiration.

Concerning the vagaries of an undisciplined reflex mechanism, one must recognize the operation of reflexes and counter-reflexes. A simple illustration will explain my meaning. In neurasthenia the patient may not be conscious of his virile impulse owing to the inhibition of the latter by inhibiting reflexes. Although potassium bromid is an anaphrodisiac when given continuously, it is frequently an aphrodisiac in neurasthenic impotency, when a single dose of 40 to 60 grains is administered. Concerning its action in this respect, which I have noted in many instances, the confidence which its sedative effect achieves could be excluded and its action attributed to a temporary abolition of the inhibitory reflex.

Exercises in Tabes.—It may not be amiss to outline briefly the principles governing a re-education of the muscular sense according to the method of Frenkel.[343] The tabetic does not die from his disease, but from its complications, and if he succeeds in maintaining his respiration, defecation, and micturition in a normal condition, the prognosis of his affection is comparatively good. The tabetic must be informed that his difficulty in locomotion is not caused by muscular weakness, but is due to an inability to coördinate. The method is governed by the general principle that writing, walking, etc., are acts acquired by learning, and that by attention and memory such acts, being partially lost, may be relearned. The motor disturbances in tabes may be attributed to disturbances of the muscular sense, muscular atony, and incoördination. The ataxia in tabes is due in part to functional and in part to anatomic changes. Simple movements are first executed with open and later with closed eyes. The primary movements consist of simple flexion and extension of the atactic extremities, and later more complicated movements are attempted. Still later, the patient is taught to stand first with open and then with closed eyes without swaying of the body. The treatment may be executed once or twice daily, and each séance must not last longer than from ten to fifteen minutes. Fatigue of the patient must be avoided. The treatment must be supervised by the physician or an intelligent nurse, for success is equally dependent on the latter as well as the perseverance of the patient.

The method of treating *tics* by re-education has been elaborated by Beutter.[284] Tic, as Brissaud has shown, is pre-eminently a motor disorder due to a defect in cortical control—to an insufficiency of volition. The principle of Beutter's method consists in gradually bringing into control the muscles which have been acting involuntarily. This control is both positive and negative; that is, the patient decrees that these muscles at times shall be active and at other times quiescent. In order to attain this end it is necessary that the subject learns to maintain a "photographic" immobility of progressively increasing duration. When the patient has reached the point where he can voluntarily reproduce his tic, he has become master of it, and is cured. These exercises are taken daily at certain hours under the direction of a physician or an intelligent person. At times the patient may practise by himself before a mirror. If any cause of this affection be discovered, it must be treated besides. This method of treatment has been followed with the happiest results in these unfortunate cases.

Forcible rhythmic compression of the chest during expiration is an excellent exercise in *asthmatics*, and I have frequently succeeded in arresting asthmatic paroxysms (which have lasted for days, even resisting anesthesia) by such compression.[365] Of late, I have seen quite a number of patients with respiratory neuroses dependent simply on a reversal of the normal type of breathing, and when costal breathing in women or diaphragmatic breathing in men has been restored, the neuroses in question were cured.

Respiratory Ataxia.—I have employed this designation in referring to many respiratory neuroses which are, in my experience, associated with a defective type of breathing with incoördination of the muscles of respiration. In males, the type is costal instead of abdominal, and in women, abdominal instead of costal. These patients have one symptom in common: a paroxysmal tendency to "catch the breath." There are, however, other symptoms, usually nervous, viz., syncope, dyspnea, cardiac palpitation, and insomnia. Mere inspection makes the diagnosis, viz., the recognition of a reversed type of breathing. Auscultation elicits no respiratory murmur in the lower lobes of the lungs in males and in the upper lobes in females. Encircling the chest with the rubber bandage to exclude costal breathing, and the abdomen in females to exclude abdominal respiration, brings immediate relief, and re-education of the type of respiration results in cure. A nasal anomaly may be the exciting factor, and this may be demonstrated by the immediate relief of the symptoms by cocainization of the nasal mucosa.

Stammering is caused by a spasm of the respiratory muscles in the act of speech, and the spasm spreads to the muscles of the throat, face, and mouth, and even to other parts of the body. In a large percentage of cases nasal obstruction may be demonstrated. Such obstruction may be detected by the *spirographs* or by directing the patient to blow out a match about a foot from each nostril in succession (mouth closed), one nostril being closed by the finger. It will also be found that in stammering the respiration is costal instead of abdominal. Educative treatment in these cases will accomplish much, provided the mechanical factors of nasal obstruction are removed.

After the acute symptoms of *chorea* have subsided (residual chorea) the movements may become chronic if untreated. Here graduated exercises, beginning with simple movements, are made, consisting of drawing, touching objects at command, placing pegs in holes, threading needles, sewing, etc.

Motor re-education of the *bladder* in tabes and other affections is attained by Sqiur as follows: The residual urine is drawn off by a catheter after each urination, and introducing a measured quantity of a mildly irritating fluid (silver nitrate, 1 : 1000) into the bladder, the patient making an effort to void it. He must be taught to make efforts at urination at stated times and always try to evacuate the bladder to the last drop. A stronger solution (grains 1 or 2 to the ounce) may sometimes be instilled into the prostatic urethra with beneficial results. The vesical spasm is best relieved by passage of a cold sound.

TESTS FOR MUSCULAR INSUFFICIENCY.

A feeble musculature is responsible for many local symptoms which are practically symptoms of fatigue which may graduate into pains. This painful fatigue is particularly observed in the muscles of the back, and after moderate development of the latter the pains in question cease. We have referred elsewhere to the dangers associated with excessive musculature, for which civilized man is not adapted, insomuch as the augmented exertion which such musculature demands throws an excessive burden on heart and arteries, thus conducing to cardiac hypertrophy and arteriosclerosis. In this connection we are only concerned with defective muscles which demand development in accordance with their physiologic employment. A rhythmic twitching of muscular fibers or bundles of fibers is frequently present in tired muscles, or it may be elicited when the muscles are struck with the finger or percussion-hammer.

The various dynamometers commonly employed for testing and dynamographs for recording muscular power are limited in their application, insomuch as only a few muscular groups can be determined by their aid. The dynamometer of Collin (Fig. 180) is usually employed in testing the muscles of the hands and arms. It is squeezed by the hand and the index shows the kilograms of pressure. The muscular power of man in health as determined by the force of the hand-grasp is equal to a pressure of 50 kgm.; a woman has about two-thirds that of a man. Dr. J. H. Kellogg, of Battle Creek, Michigan, has perfected a universal dynamometer by means of which the strength of every important group of muscles of an individual can be tested (Fig. 181). The following table represents the relative strength of the several groups of muscles as determined by the universal dynamometer:

Men.	
Muscles of inspiration (pneumatometer)	0.9
Muscles of expiration (pneumatometer)	2.6
Neck Anterior	35
Hand-Extensors	54
Neck Posterior	75
Arm-Flexors	120
Neck Lateral	126
Arm-Extensors	127
Forearm-Pronators	134
Trunk Anterior	139
Deltoid	140
Forearm-Supinators	143
Foot-Flexors	145
Shoulder-Retractors	160
Inspiration (waist)	172
Latissimus Dorsi	185
Inspiration (chest)	190
Leg-Flexors	200
Thigh-Abductors	206
Pectoral	209
Thigh-Adductors	227
Leg-Extensors	237
Hand-Flexors	249
Trunk Lateral	287
Thigh-Flexors	303
Thigh-Extensors	330
Chest	365
Trunk Posterior	380
Foot-Extensors	614
Left Arm	751
Right Arm	770
Trunk	1042
Right Leg	1131
Left Leg	1131
Chest and Trunk	1407
Both Arms	1521
Both Legs	2262
Entire body	5190

Women.	
Muscles of inspiration (pneumatometer)	0.4
Muscles of expiration (pneumatometer)	1.4
Neck Anterior	19
Hand-Extensors	29
Neck Posterior	37
Arm-Flexors	48
Arm-Extensors	53
Forearm-Supinators	57
Forearm-Pronators	57
Neck Lateral	60
Deltoid	71
Trunk Anterior	73
Inspiration (waist)	79
Inspiration (chest)	85
Foot-Flexors	89
Shoulder-Retractors	95
Latissimus Dorsi	99
Pectoral	102
Leg Flexors	116
Leg-Extensors	123
Hand-Flexors	125
Thigh-Abductors	135
Thigh-Adductors	142
Trunk Lateral	154
Chest	166
Trunk Posterior	173
Thigh-Extensors	174
Thigh-Flexors	179
Left Arm	363
Foot-Extensors	364
Right Arm	373
Trunk	516
Left Leg	659
Right Leg	663
Chest and Trunk	682
Both Arms	736
Both Legs	1322
Entire body	2740

I employ the following simple test for the neuro-muscular fatigue in neurasthenic subjects: If the patient is directed to make some unusual muscular contraction like extending the fingers on the hand, the contraction cannot be sustained. If the physician observes the dorsum of the hand of the patient when the extension is executed, he notes an immediate partial relaxation of the muscles, which increases with augmented fatigue of the subject (Fig. 182).

Ergograph.—When a muscle is fatigued in the intact body, it is not only a poisoning of the end-plates of the muscles, but the products of muscular contraction intoxicate the central nervous system. In using the ergograph, the arm, hand, and all the fingers but one are fixed in a suitable holder; the free finger repeatedly lifts a weight over a pulley, and the height to which it is raised is registered by a marker on a blackened surface (Fig. 183). By means of the ergograph it can be shown that the central nervous system is more easily fatigued than the nerve-endings in muscle. Thus, if the weight can no longer be lifted under the influence of the will, and, without waiting for the fatigue to pass off, the finger-

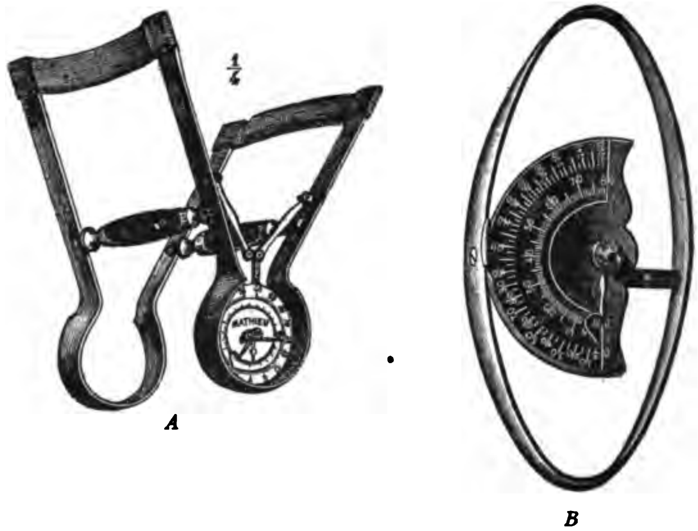


Fig. 180.—Dynamometers: *A*, Universal dynamometer of Axenfeld; *B*, dynamometer of Collin.

muscles are stimulated artificially by induction shocks, they can again perform vigorous contractions.

Electro-diagnosis.—The muscles may be tested by noting the strength of the galvanic current (read in milliampères) and faradic current (measurement on the scale of the secondary spiral and expressed in millimeters of coil-distance) necessary to produce the minimal contraction. The muscles of the healthy side may be used as a standard for comparison, otherwise we must be governed by the reactions observed in the average individual with normal musculature. One notes that when the muscles are weak, with the strongest current the contraction of the muscles may be no greater than with weak currents. The implicated muscles do not contract *in toto*, but only a few bundles contract and appear as slightly prominent ridges. The faradic current provokes no tetany, but only several clonic contractions of the muscle-substance, which succeed each other during the closure of the current (myoclonic contractions).

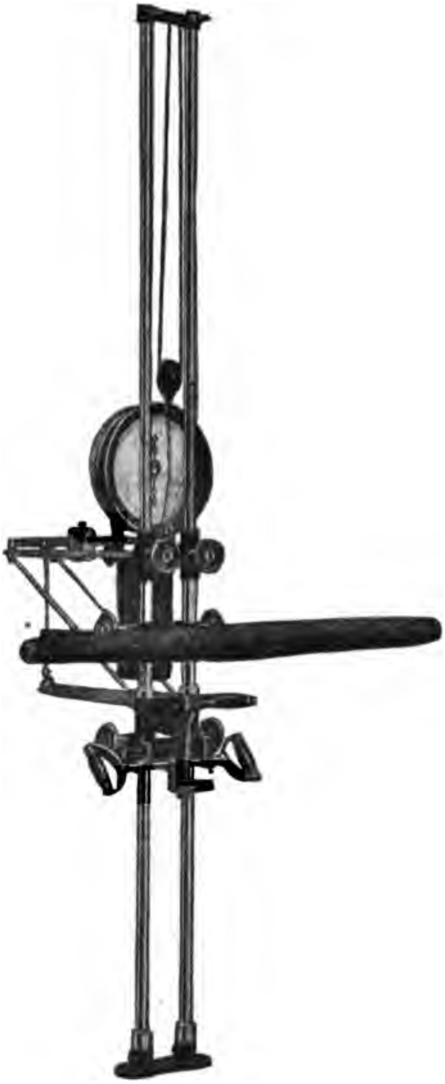


Fig. 181.—Kellogg's universal dynamometer.

Clement[207] and others have demonstrated, by means of the ergograph and otherwise, that *formic acid* increases the muscular power in doses of from 2 to 3 grams per diem. The ordinary commercial formic acid is 50 per cent. in strength, and the amount of this required is 4 to 6 grams. It is given in water, neutralized with sodium bicarbonate. It also influences smooth muscular fibers, hence in difficult micturition dependent on feeble muscular power of the bladder in old men it has been used with satisfactory results. In *asthenopia*, unassociated with errors in the refraction, Jacqueau instils three times daily into both eyes an aqueous solution of sodium formate (1 : 30 to 50), which in exceptional cases caused a slight burning sensation. An almost immediate suppression of the functional disturbances was noted in several instances, which was attributed to the increased vigor of the ocular muscles.

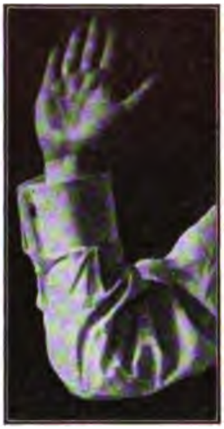


Fig. 182.—Posture of the hand in testing neuro-muscular fatigue.

Croom[283] has demonstrated the value of formic acid in cardiac failure observed in diphtheria. He reports one hundred cases.

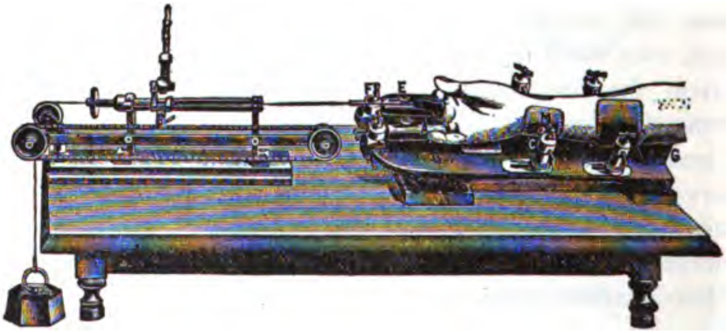


Fig. 183.—Ergograph.

All the patients received the 25 per cent. formic acid solution in 5- to 20-minim doses for ten to fourteen days after admission to the hospital. Otherwise the treatment was the usual one for diphtheria, including the use of antitoxin. This series of cases was compared with an equal number which were treated in previous years without the formic acid. The death-rate from cardiac failure was apparently reduced from 8.6 per cent. to 2 per cent., and some of these cases had shown evidences of such cardiac involvement as to warrant a very bad prognosis. In the two patients who died the toxemia was profound before the first administration of the drug. The main features in all the cases were the marked regularity of the pulse, even after a previous irregularity had been present, and a noticeable improvement in the general nutrition, which points to a successful combating of the toxemia. The number of instances in which paralysis occurred was very small (only 3 per cent.).

Gordon[223] emphasizes the great value of *phosphorus* in all asthenic conditions. Phosphorus exists in the brain and nervous tissue in organic combination, and lecithin, protagon, and cerebrin are well-known phosphorus-compounds in the nervous system belonging to the glycerophosphoric group. The best results therapeutically are achieved with the glycerophosphates. It is true that our neurasthenics may receive benefit in every direction but one, and that is the relief of exhaustion, and in such instances the phosphorus compounds are especially indicated. *Caffein* facilitates muscular work by augmenting the activity of the cerebrospinal centers; it reduces the sensation of effort and abolishes fatigue. *Sugar* is a potent muscle-food and justifies the observation that sugar may decide a battle. Experiments show that sugar is a most potent food for augmenting the powers of endurance.

In *talipes*, to determine whether the muscles will recover, increase the equinus deformity and note if any extending movements of the toes can be voluntarily executed. If there is the slightest movement of the extensor muscles, the tone of the muscles will be restored, provided the foot be kept at right angles for a sufficiently long time and the limb be well massaged (Jones).

The Therapeutics of Muscular Exercise.—It may be apposite to consider briefly this important subject. Half the body-weight is contributed by the muscular system, and even when at rest, the latter contains about one-fourth of the total quantity of blood. The latter is, however, very much augmented when the muscles are active. The source of this blood is most probably from the splanchnic vessels. Thus Oliver has shown that although after a period of rest a large quantity of blood can be expressed into the general circulation from the abdomen, after exercise no such transference ensues by compression of the abdomen. Catabolism is essentially the function of muscular activity, and the oxidation of the ingested food is dependent on the energy liberated by the muscles. Muscular exercise increases respiratory activity and augments the capacity of the lungs; it is a tonic to the circulatory system and it augments the elimination of waste-products in the blood. Muscular exercise is necessarily neuro-muscular activity, yet the nervous system is influenced for either weal or woe. Thus exercise demanding the domination of will tends to depress the nervous system, whereas the more independent it is of the higher cerebral centers (automatic exercise), the more it tends to stimulate the emotions. All fatigue associated with exercise is exhausting. The quantity of exercise needed for the average individual is dependent on a number of factors. Thus the individual who employs his brain inordinately can endure little muscular exercise, for he soon finds that he expends a double amount of energy, for the latter is an expenditure of nerve-force, whether expressed in cerebral or muscular action. The individual who eats to excess demands more exercise than the moderate eater.

Excessive exercise strains the heart and blood-vessels, and the associated increased catabolism of the muscles conduces to the creation of extractives which intoxicate the body, notably the nervous system. It is a well recognized fact that fat disappears most rapidly in juxtaposition to muscles which are most exercised. Thus abdominal exercises will diminish abdominal fat, and fencing, the fat in the upper part of the body.

In disease when muscular exercises are prescribed all the precautions must be taken as cited in the discussion of the resistance movements (page 481). Tuberculous patients who even have a normal temperature at rest show after exercise a more pronounced rise by rectum than normal persons (Penzoldt's phenomenon).

TEST OF CONDITION.

C. Ward Crampton[200] observes that there is a decided necessity for a reliable test of condition, so that the physician can determine the relative degree of health of the patient who comes under his care for the first time. The test employed by Crampton consists in the comparison of the systolic blood-pressure and the heart-rate of the recumbent position with those of the standing position. The physiology involved is as follows: In standing the splanchnic veins are constricted by the vasomotor action of the splanchnic nerves. If this contraction is effective against the increased pressure brought to bear through the gravity, the blood-pressure in the upper body rises; and if ineffective, it fails to rise or falls. The splanchnic vasomotor mechanism is the latest in the body to develop, and it appears only after man has taken to the erect position. The mechanism in question is easily fatigued, and, according to my observations, its exhaustion is one of the earliest expressions of neurasthenia.* When the blood-pressure falls, the heart-rate is accelerated. If the rate of the heart is increased with an augmentation of blood-pressure, it indicates a relative insufficiency of the splanchnic mechanism, for the ideal "condition" is a rise of pressure with no acceleration of the heart on standing. In employing this test, the patient is directed to lie down flat upon a couch with no head-rest. The armlet of the blood-pressure instrument is placed around the upper arm so that it bears the same relation to the heart lying as it will when the patient is standing, thus eliminating any hydrostatic error. After the average pulse-rate is taken, the blood-pressure (systolic) is determined. The pulse-rate and pressure are now estimated in the erect posture. The patient must be allowed sufficient rest in both instances before estimations are made, insomuch as muscular effort alone will modify the pulse-rate and pressure.

In the following case the test shows a good condition:

	PULSE-RATE.	SYSTOLIC PRESSURE.
Lying	58	120 mm.
Standing	58	132 mm.
Difference	0	+12 mm.

---

* *Vide* vasodilators (page 371). The splanchnic circulation properly signifies the arterial branches of the celiac axis, their branches, and the radicles of the portal vein. This system is partly arterial and partly venous..

The following case shows a poor record:

	RATE.	PRESSURE.
Lying	68	100 mm.
Standing	104	94 mm.
Difference	+36	—6 mm.

More accurate conclusions may be formulated when the condition is already known, and the test in question may be accepted as a means of indicating the progress made in chronic cases and the value of the remedies employed.

Vide Quinquaud's sign.

SUFFICIENCY OF THE FOOT.

Many painful affections of the lower extremities specified as rheumatic or neuralgic owe their origin to disabilities of the foot. The latter as the offending factor is frequently ignored because the reflex pains are often located in regions far removed from the foot. Many conditions described as sciatica are really caused by some pedal infirmity. More recently the condition known as *meralgia paresthetica* has been referred to the same origin. The latter affection has heretofore been regarded as a neuritis of the external cutaneous nerve and is characterized by sensory disturbances over the outer side of the thigh. The most frequent pedal infirmity is the **weak-foot.** The chief function of the foot is the support of body-weight, and the most characteristic sign of a weak-foot is the sensation of weakness, which soon graduates into pains extending to the knees, hips, and lumbar region. The fact that the pains are intensified when the foot is in use and in damp weather, and that temporary rest causes a remittance of symptoms, often accounts for the erroneous diagnosis of rheumatism.

Another frequent symptom is the discomfort experienced on changing from a position of rest to activity. Later the pains and cramps in the legs persist even during rest. It will be noted that there is an exaggerated turning out of the feet, and that in the slouchy gait of the patient the leg is never completely extended. Examination of the worn shoe shows that it is bulged inward at the arch or worn away on the inner side of the sole. The line of strain or leverage is determined on the nude feet. A line drawn from the center of the patella down the crest of the tibia and continued over the foot should meet the interval between the second and third toes; if it falls over or inside the great toe, it shows that the foot is working at a disadvantage (Whitman). The internal border of the foot should curve slightly outward, and when the feet are placed side by side with the heels and toes together, a space should be present between the arches; if this concavity is replaced by a convexity when weight is borne, it constitutes, according to Whitman, the earliest and sometimes the only evidence of deformity. Limitation of the range of motion is an early symptom of weakness, and the most important test is that of adduction, which in many instances of weakness the patient is unable to execute. It is not difficult to diagnose a weak foot when there is flattening of the arch with abduction of the foot, but the patient often suffers most when the latter symptoms are absent. The weak is the initial stage of the flat-foot. The bearing surface of the foot may be determined by an impression on carbon paper or by smearing the sole with vaselin. An exact method and one adapted for permanent impressions is the following, recommended by Schüman: The paper to be used is lightly coated with a solution of ferric chlorid diluted one-half and may be kept on hand until needed for use. The patient's foot receives a thin coating of a 5 per cent. solution of potassium ferrocyanid, and he is then instructed to press it firmly on the prepared paper. The result is a very clear, dark blue reproduction of the sole on a yellow background. The course of the papillary lines is readily recognizable, and the pictures obtained in this way are full of details.

Lawrie[260] contends that the latter method is troublesome and it is difficult to get the foot evenly wetted with the ferrocyanid solution. The method advocated by Lawrie is that employed in taking impressions of finger-tips for identification purposes. The materials required are a glass slab, 16 inches by 13 inches, a roller, and a tube of specially prepared printer's ink. A thin film is pressed out on the glass plate by the roller, and after standing on this the patient transfers his blackened sole to a sheet of paper. It is important to see that the patient puts his weight on the foot during both parts of the process. The result is an accurate and permanent impression of the weight-bearing portions of the foot.

The foot can be easily cleaned with soap and water. The impressions may be photographed and reduced in this way to a size suitable for the note-book. The illustrations are from photographs of such impressions (Figs. 184, 185, 186). A normal impression (Fig. 184) is not usual: *pes cavus* with crowded toes, the result of wearing high-heeled shoes, is shown in Fig. 185, and Fig. 186 illustrates a case of flat-foot.

The diagnosis of pains in the lower extremities is often established by treatment directed toward the cure of the weak-foot. This consists in supporting the plantar fascia and in developing the tibialis posticus muscle, the tendon of which passes beneath the fascia and strengthens the latter. To accomplish the first object, according to McWilliams,[201] the foot being held forcibly in adduction and dorsal flexion, a strip of two-inch adhesive plaster is started at the external malleolus and carried under the sole and up the inside of the leg almost to the knee. A second strip is passed similar to the first and just in front of it, the object of these strips being to hold the foot in adduction and to take off the tension from the weakened fascia. To develop the tibialis posticus muscle, the patient is instructed to go through the exercise, morning and night, of raising himself on his toes, and then throwing out his ankles, to come down on the outer border of his feet to his heels again. The patient should be told to walk with the feet held parallel to each other and to remain in this attitude when standing. If the above

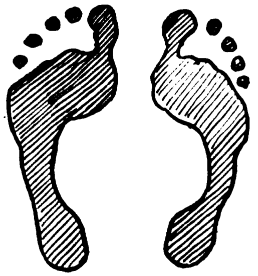


Fig. 184.—Impressions of normal feet.

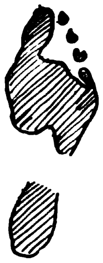


Fig. 185.—Illustrating the effects of high-heeled shoes.

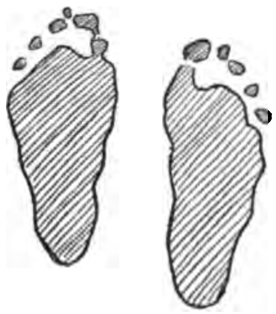


Fig. 186.—From a case of flat-foot.

adhesive inversion strips do not support the ankle sufficiently, as evidenced by the continued presence of pain, then, in addition to the inversion strips, the ankle may be strapped with a one-inch figure-of-eight, each turn overlapping the preceding by about half an inch. This strapping goes down the outer side of the foot, under the sole, up the inner side, around the leg, and down again. The sole of the shoe may also be built up one-third of an inch on the inner side of its exterior. When the foot has become actually flat, in addition to support one must lift up the arch, which must be done gradually, and one must also overcome the adduction. In many patients to lift the arch up to its full height suddenly and at once by a flat-foot plate causes torture and is entirely unnecessary. Felt pads are used, cut to fit each individual foot, the highest part of the pad being placed under the prominent head of the astragalus. This pad is elevated in height gradually in each successive one. Inversion and adduction straps are used as already described over this pad. One must continue to elevate the arch until there is a cessation of pain, and no further than that point, for this indicates the normal height of that particular arch, and to still further elevate it would only continue the pain. One may now fit a flat-foot plate into the shoe, but the plate should be no higher than the already elevated arch. The same exercises are employed as before. At the time of applying each pad the foot should be massaged and gradually twisted into its proper position, *i. e.*, into adduction.

When the flat-foot is so fixed in its deformity as to be immobile, then there is no way but to give ether, forcibly correct the deformity, and after the foot has been forced into inversion and adduction, it is put up in a plaster splint for a month, after which it may be treated as an ordinary flat-foot.

Painful Heel.—This is caused by shortening of the gastrocnemius, and is frequently relieved by supporting the arch of the foot, although in many instances the support of the foot is ineffective until high heels are worn, which, according to Nutt,[259] relieve the tension on the gastrocnemius.

Morton's metatarsalgia is either a neuritis or neuralgia of one of the metatarsal nerves, usually that between the third and fourth toes, caused by compression of the nerve between the metatarsal bones, which come together owing to the breaking down of the anterior transverse arch under the ball of the foot. The latter condition is amenable to treatment by means of a small pad which is fixed in the center of the ball of the foot and held in place by a transverse piece of adhesive plaster, which prevents the metatarsal bones from spreading apart. Anterior metatarsalgia refers to pain and discomfort about the anterior metatarsal arch. It is most frequently caused by incorrect shoes. One finds in these cases a depressed metatarsal arch, and impressions of the foot show more weight-bearing surface than normal. The accompanying illustrations are taken from the contribution of Epstein[261] on the subject (Figs. 187, 188).

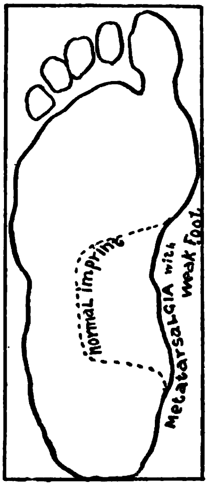


Fig. 187.—Outline of foot obtained with petrolatum in a case of anterior metatarsalgia. The dotted line represents the imprint of a well arched foot of equal size.

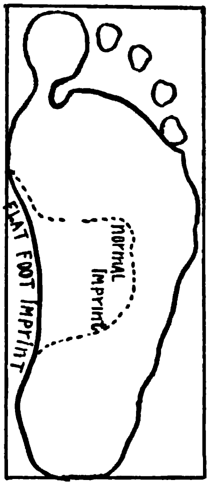


Fig. 188.—Impression of a flat-foot. The patient complained of pain in the region of the metatarsus only.

Respecting the treatment of this affection, Epstein discusses it as follows: The first requisite is a proper shoe. The shoe must be of correct shape with a firm sole, generous breadth to avoid compression of the toes, a low heel, and a high arch to distribute some of the weight to the arch of the foot. The "rocker" sole makes matters worse. Adhesive zinc oxid plaster strapping, about three-quarters of an inch wide, is wound around the metatarsal arch to support it, or even the entire metatarsus may be tightly strapped. A pad of piano felt one-half by one and one-half inches, placed longitudinally just beneath the affected joint and fixed with adhesive plaster, gives great comfort at once in most cases. Half of a soft-rubber ball may be used instead of the pad. Thus the arch is supported, and overriding prevented temporarily. For permanent use, it has been found that a long metal plate molded on a plaster-of-Paris cast is much more efficient in supporting the transverse arch. It can be extended so as to brace the longitudinal arch also. A piece of leather oval, with beveled edges, may be fixed to the sole of the shoe at the proper point. The patient is then instructed to exercise daily the muscles of the foot and toes, to make proper use of the big toe in walking, and to avoid throwing the foot out in doing so. Daily massage and forcible manipulation of the toes go a long way in overcoming rigidity. The general health is built up, electricity, preferably faradic, is employed, and applications for removal of corns are prescribed.

For flat-foot, with metatarsalgia, plaster strapping of the foot in the adducted position has proved of great value as a temporary method of treatment. The patient's sole is raised one-quarter inch on the inner border of the shoe, and Whitman's plates are ordered, made on molded plaster casts, and the patient is instructed by exercises to strengthen the tibialis anticus and posticus. Pads, as described before, are applied to the metatarsal arch, or the flat-foot plate is extended, to support the same in front. For the non-deforming club-foot, with its tender, clawed toes, Professor Shaffer's traction shoe is especially serviceable in all cases, and usually preferable to subcutaneous tenotomy of the tendo Achillis and contracted plantar fascia. This is the form of metatarsalgia in which callouses are always troublesome and should be properly pared. A foot-plate which equalizes the pressure on the sole may be used here to advantage. In the cases of *erythromelalgia*, marked benefit has followed swabbing of the entire foot with pure carbolic acid, followed directly by washing off with ordinary alcohol once a week.

Footwear.—Protection of the feet against dampness is of the greatest hygienic importance. Whenever the feet become damp, the loss of heat becomes excessive. According to Pettenkofer, if the stockings contain an ounce and a half of moisture, the quantity of heat necessary to convert it into vapor is equal to that necessary to melt more than one-half pound of ice or to raise the temperature of half a pound of water from the freezing- to the boiling-point.

Footwear should conform to the physiologic anatomy of the foot. Correct shoes can often only be made to order upon lasts made from a tracing of the foot. A proper shoe should be nearly straight on the inner side with a gentle curve on the outer side. The sole should be flat, not curved. A hygienic shoe should have a sole corresponding in shape to the impression of the normal foot. Corns, bunions, ingrown toe-nails, etc., owe their origin to badly constructed shoes. Heels should be broad and low. High heels weaken the arch of the foot through atrophy of the plantar ligaments. Shoes should be a little longer than the foot, but not so long as to permit friction of the shoe against the foot in walking. Patent leather shoes do not permit of sufficient circulation of air unless they contain a special ventilating device.

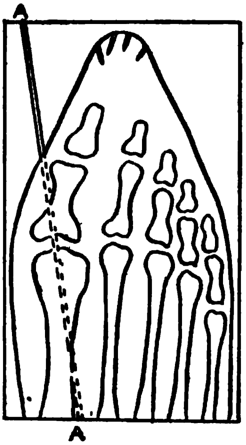


Fig. 189.—A woman's foot in a pointed-toed stocking and pointed-toed shoe. *A–A*, Meyer's line.

Many shoes sold as anatomically correct are anatomically incorrect. Meyer first called attention to the fact that in a normal human foot a line drawn from the center of the os calcis through the center of the metatarsophalangeal joint of the great toe would pass through the center of the distal phalanx of that toe; and, further, that lines drawn through the center of each of the toes should converge at the same point. *Meyer's line* is of great value in the study of foot deformities superinduced by faulty shoes, and can be employed with or without the aid of the *x*-rays (Fig. 189).

Thomas S. Ellis and H. Augustus Wilson have both shown that much of the evil charged to shoes is produced by the ordinary median-pointed or even-sided sock. A separate stall for the

PLATE XXVII.

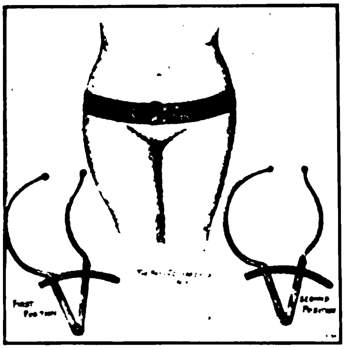
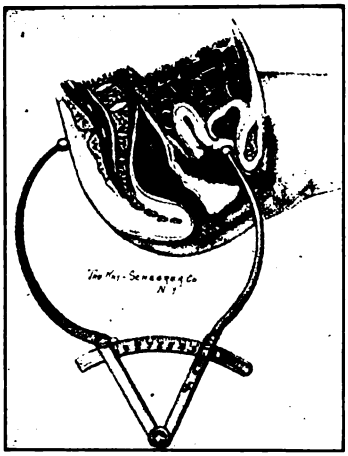


Fig. 190.



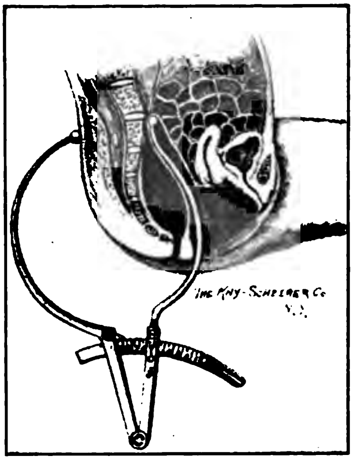


Fig. 191.

Fig. 192.

Figs. 190, 191, and 192.—Illustrating Jacobson's method of pelvimetry.

great toe is desirable, but the sock with a straight inside line will suffice.

PELVIC SUFFICIENCY.

Deformed pelves are comparatively frequent and offer the chief obstacle to the delivery of the fetal head at term. When the pelvic contraction is slight, spontaneous or instrumental delivery may occur without injury to either mother or child; but if the contraction is more pronounced, either instrumental delivery is imperative or delivery through the natural passages is impossible. Inspection of the patient may aid in the recognition of a pelvic deformity, but no absolute deductions can be made therefrom, hence pelvimetry is absolutely necessary. S. D. Jacobson[203] deprecates the inaccuracy of pelvimetry as conventionally employed, and suggests the employment of a new instrument for measuring all the diameters of the pelvis in the living woman. The shape of the pelvis can also be determined and the presence of abnormalities noted (Figs. 190 to 194). The instrument is constructed of steel and has two branches in the form of calipers—the outer or semicircular branch, and an internal S-shaped branch. It has a movable gage, and the instrument can be set by a thumbscrew. The removable branch is attached to the handle by a pin and socket, which is further secured by a sliding clip. The upper ends of the branches are ball-pointed and can be separated about twelve inches. A leather belt accompanies the instrument, which is graduated in inches, halves, and quarters, beginning at the bottom and reading from right to left. The internal branch of the instrument is likewise graduated from the ball downward. In employing the instrument the bladder and rectum are first emptied, and the patient is placed on the left side upon a table and the knees drawn up. The belt is fastened around the hips so that the end of the buckle is just over the symphysis pubis and exactly in the median line. The belt should pass posteriorly at about the center of the sacrum and is drawn fairly tight. The movable or internal branch is then introduced, while the fixed branch is placed posteriorly against the belt. The movable branch is then brought in contact with particular bony points on the internal surface of the pelvis, the distance being recorded on the gage.

To ascertain the true conjugate diameter of the brim, place the tip of the fixed branch on the strap over the middle of the sacrum· Place the tip of the movable branch in the middle of the posterior or vaginal surface of the symphysis pubis. Move the sliding gage firmly against the handle of the movable branch and fix it with the set-screw. With the index and the middle fingers of the right hand guiding the internal branch, depress the posterior vaginal wall, and with its tip probe for the sacral promontory. Holding the instrument steadily, the number of inches is read off on the gage.

To find the transverse diameter of the brim, note the number on the graduated belt, which is in exactly the median line of the sacrum. Place the tip of the fixed branch on the strap at exactly half that number of inches. This will put it over the center of the pelvis. With the movable branch in the first position, go straight across the middle of the pelvis and high enough to reach the bony ridge, which is the iliopectineal line. Move the sliding gage up firmly and set it with the screw. Withdraw the movable branch, make it assume the second position, and make its point reach up to the iliopectineal line toward you, facing the tip of its fellow on the strap. Read the number of inches recorded on the gage.

To measure the oblique diameter of the brim, read the number on the belt exactly in the median line over the sacrum, subtract one-fifth of that number, and place the tip of the fixed branch on the strap at that spot. This will be just over the sacroiliac joint. With the movable branch in the first position within the vagina find the left iliopectineal tubercle diagonally across the pelvis. Move up the sliding gage and set it with the screw. Withdraw the movable branch, make it assume the second position, and with its tip find the right sacroiliac joint, so that as the tips of the two branches face each other they include the right posterior pelvic quadrant. Read off the number of inches indicated on the gage.

To find the inferior conjugate, place the tip of the fixed branch on the strap as low down as possible on the median line of the sacrum. The tip of the movable branch in the first position finds the lower edge of the symphysis pubis. The movable branch is withdrawn and its tip in the second position made to touch the sacrococcygeal joint. Read the number of inches recorded on the gage.

PLATE XXVIII.

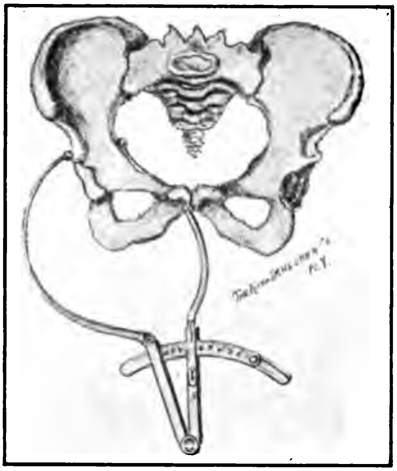


Fig. 193.

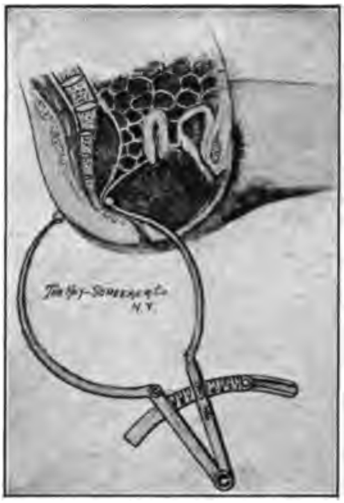


Fig. 194.

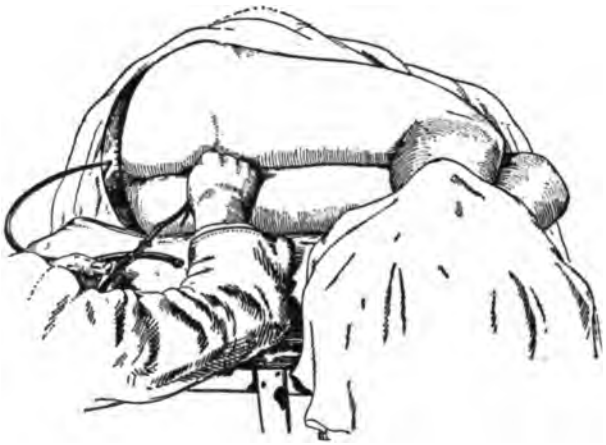


Fig. 195.

Figs. 193, 194, and 195.—Illustrating Jacobson's method of pelvimetry.

To find the transverse diameter of the outlet, the patient should be on her back with the knees well drawn up. The skin should be marked over the inner edges of the tuberosities of the ischium. A ready measurement of the transverse diameter of the outlet is found by passing four fingers abreast between the tuberosities of the ischium. If the space is sufficient to admit the four fingers comfortably, it may be assumed that no contraction exists (Fig. 196). If the perineum is rigid and the vagina is contracted, the promontory can be reached through the rectum if the latter is inflated. In fleshy patients with a tense abdomen it may be necessary to put the patient in the knee-chest position so as to distend the vagina with air. In this way it is easy to make out the bony landmarks.

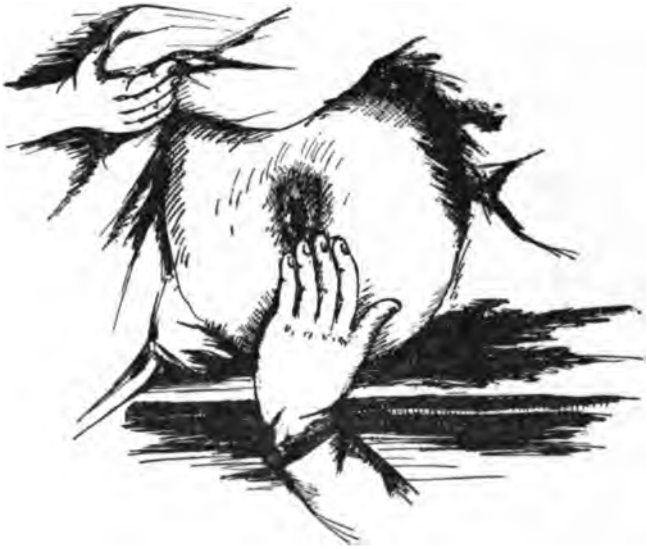


Fig. 196.—Measuring the transverse diameter of the outlet.

According to Jacobson, the pelvic diameters can be measured in about five minutes. The *normal pelvis* (of the adult female) measures as follows at the inlet:

Superior conjugate or anteroposterior diameter of the brim	11 cm., or 4½ inches.	
Transverse diameter	13 cm., or 5¼ inches.	
Oblique diameter	12 cm., or 5 inches.	

At the outlet:

The inferior conjugate from symphysis to junction of sacrum and coccyx	11½ cm., or 4¾ inches.
Transverse or intertuberal diameter	11 cm., or 4½ inches.

It would be obviously incorrect to measure the inferior conjugate from symphysis to tip of coccyx, as this bone can be moved backward two or more centimeters by the advancing child's head. These measurements are given as normal by most recent authorities. However, these figures do not hold good for pelves showing racial characteristics, such as the Negress or Mongolian woman.

During labor these measurements may be increased in certain directions owing to the physiologic softening and slight lengthening of the pelvic ligaments, and the conjugate diameter may be lengthened one-half centimeter by the patient assuming Walcher's position, namely, with her thighs hyperextended.

If any pelvic diameter is shortened, the pelvis is said to be contracted in that diameter. It may, however, be contracted in more than one, or in all diameters, which will produce regular or irregular contraction, the pelvis changing the shape as well as size accordingly.

The external conjugate (Baudelocque's diameter) represents the distance between the upper edge of the symphysis pubis and the tip of the spinous process of the fifth lumbar vertebra, and may be measured with calipers. When less than 19 cm., the pelvis is too narrow for safe delivery. The diagonal conjugate, which is the distance from the vertex of the pubic angle to the promontory of the sacrum, may be approximately measured by the finger; in the norm the promontory cannot be reached by introducing a single index-finger.

Zweifel has suggested a simple instrument (Fig. 197) for measuring the conjugata vera. It consists of a metal tube, inside of which is a pliable metallic spring of German silver carrying a graduated scale at both ends.

Mensuration of the Child in the Uterus.—Ellice McDonald[278] observes that exact pelvic measurement is a work of supererogation and futile unless some attempt be made to estimate the size of the fetal head. A knowledge of the size of the fetal body and head offers a certain basis for obstetric prognosis and for choice of operation. Estimation of the duration of pregnancy may be made by measuring the uterus from the symphysis to the fundus, and the following rule is easily recalled:

Duration of pregnancy in lunar months = Height of uterus in centimeters ÷ three and one-half.

Thus, if a uterus measures 25 cm. from symphysis to fundus, the duration of pregnancy is seven and three-sevenths lunar months, or seven lunar months and twelve days: or, if 35 cm. is the measurement from symphysis to fundus, the duration of pregnancy is ten lunar months or the patient is at full term. The tape should follow the contour of the abdominal wall, save at the last dip. The upper hand should be placed at the highest part of the fundus and held perpendicular to the long axis of the body, while the tape is held against the middle finger by the thumb. Multiparæ with thin, soft uteri and lax abdominal walls should be supported at the sides by an assistant, so as to bring the occipito-coccygeal axis of the fetus into the long axis of the body.

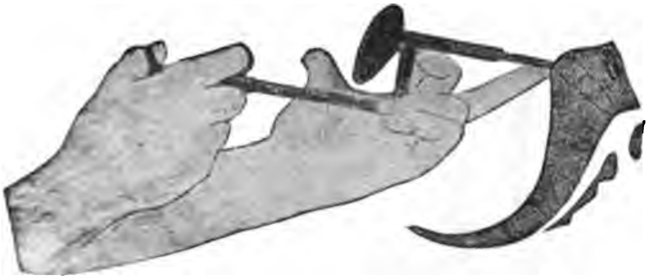


Fig. 197.—Zweifel's instrument and method of employment for measuring the conjugata vera.

This method gives satisfactory results and is the most exact means of estimation of the duration of pregnancy by measurement of the size of the uterus. The height of the uterus depends mainly on the length of the occipito-coccygeal measurement. This varies but little in babies of various weights. The amount of the liquor amnii does not affect the measurement, inasmuch as excessive fluid goes rather to increase the bulk than the length of the uterus.

It may be said that 35 cm. is the usual height of the uterus at full term when the fetus approximates 3300 grams, the average

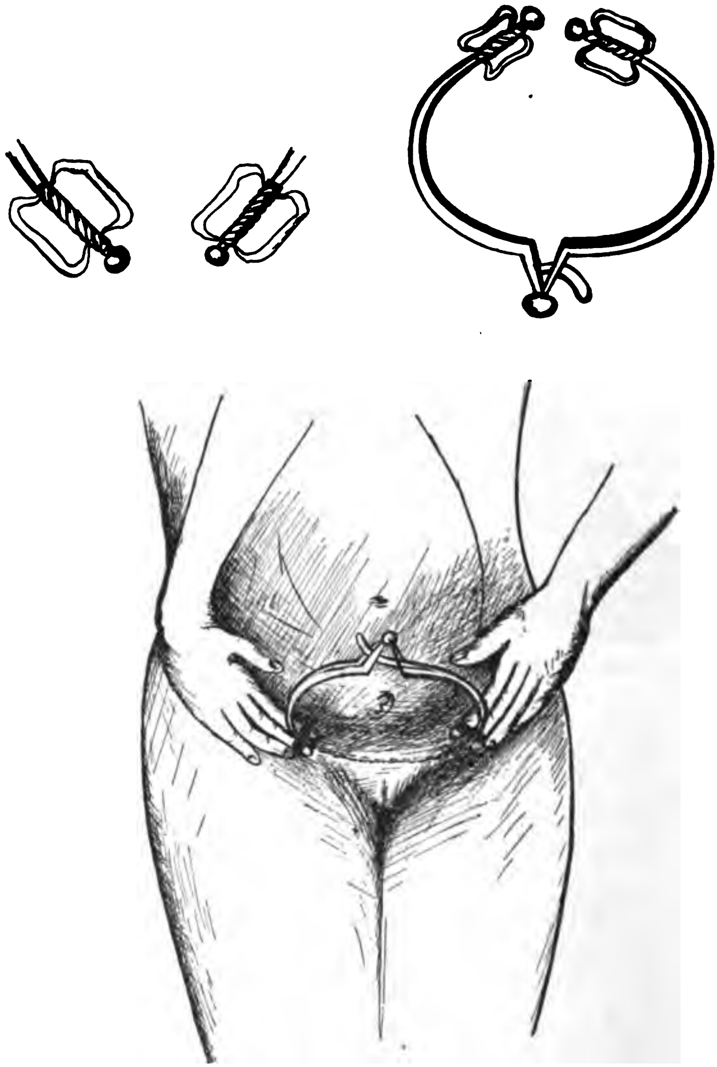


Fig. 198.—McDonald's method of cephalometry.

weight of the babies studied. For every centimeter of height above this measurement, approximately 200 grams should be added to this weight. Thus a uterus measuring 38.5 cm. contained a fetus weighing 4000, and one measuring 40 cm. and with hydramnios contained a fetus weighing 4200 grams.

Measurements of the head may be made with an ordinary pelvimeter (Fig. 198) with two rings of adhesive plaster, about 1 cm. in width, fastened to each tip. These rings are faced inside with adhesive plaster, back inward, and are made sufficiently large to readily admit the middle and ring fingers. The knob-like tips of the pelvimeter should project about 1 cm. beyond the palpating fingers. The occiput and sinciput are located; then the fingers are thrust into the rings and the knobs of the instrument approximated to these points as closely as possible. The tips are held firmly against the cephalic poles and the scale read. This gives the occipito-frontal diameter. All heads above the brim or which may be thrust above the brim can be measured. The heads of one hundred new-born babies were carefully measured, and it was found that, while the average difference between the occipito-frontal and biparietal diameters was 2.33 cm., the difference increased with fair regularity according to the increase in size of the occipito-frontal measurement.

TABLE OF MEASUREMENTS OF ONE HUNDRED NEW-BORN BABIES.

Number of Cases.	O. F. Diameter.	Average Difference.	Average Weight.
1	10.00	1.00	2,600
4	10.50	1.55	2,716
8	10.75	1.81	2,975
17	11.00	1.91	3,100
21	11.25	2.07	3,156
19	11.50	2.26	3,247
9	11.75	2.50	3,313
13	12.00	2.30	3,514
5	12.25	2.35	4,100
1	12.50	2.50	4,100
2	12.75	3.12	4,350
100		Average 2.33	

Thus it may be seen that with the increase in the occipito-frontal diameter, the difference between it and the biparietal is also increased. So from an external occipito-frontal measurement of 11.25 cm., 2 cm. were deducted in order to obtain the biparietal;

from 11.50 cm. occipito-frontal, 2.25 cm., and from 12 cm. occipito-frontal, 2.50 cm.

It will be also seen from the table that the weight increased with the increase in the occipito-frontal diameter.

VERTEBRAL INSUFFICIENCY.

Schanz[345] has observed this condition in individuals between the ages of twenty and forty years who complain of severe pains in the back. The vertebræ are found to be sensitive on percussion, especially the spinal processes. The bodies of the lumbar vertebræ are equally sensitive, and this may be demonstrated by deep abdominal pressure when the fingers attain a point where the pulsations of the abdominal aorta are perceptible. Another symptom noted is the difficulty which patients experience in changing the dorsal for the ventral posture. Very often vertebral insufficiency is regarded as an expression of neurasthenia, insomuch as the patients have neurasthenic symptoms, or, if they are women, they are treated for pelvic troubles. Many of these cases were at one time regarded by Schanz as tuberculous spondylitis, but subsequent observation convinced him of the error of his primary diagnosis. Treatment is usually effective by rest, massage, and especially the employment of an orthopedic corset. Several of his patients declared that the commencement of the vertebral pains dated from the moment when they dispensed with corsets, to which they were habituated.

BIBLIOGRAPHY.

1. Harris: Journal Amer. Med. Assoc., Oct. 27, 1906.
2. Abrams: Man and his Poisons, 1906.
3. Schofield: Nerves in Disorder, 1903.
4. Dock: Boston Med. and Surg. Journal, June 9, 1904.
5. Abrams: Medicine, Aug., 1905.
6. Abrams: The Blues (Splanchnic Neurasthenia), 2d ed., 1906.
7. Engman and Mook: Journ. Amer. Med. Assoc., Dec. 8, 1906.
8. Abrams: Diseases of the Heart, p. 155. 1900; Medical Record, Jan. 5 1901.
9. Abrams: American Medicine, Jan. 3, 1903.
10. British Medical Journal, Epitome, 1, 1904.
11. Beesley: British Medical Journal, May 19, 1906.
12. Abrams: Occidental Medical Times, Jan., 1902.
13. Senn: Wochenschrift f. Ther. u. Hygiene des Auges, Aug., 1905.
14. Brav: American Medicine, July, 1906.
15. Ball: Modern Ophthalmology, p. 255.
16. Hadden: Medical News, xlviii, p. 155, 1886.
17. Weber: New York Medical Journal, Nov. 3, 1906.
18. Cabot: Journ. Amer. Med. Assoc., March 17, 1906.
19. Schmidt: Münch. med. Wochen., No. 41, 1905.
20. Abrams: Man and his Poisons, 1906; Splanchnic Neurasthenia, 1906.
21. Gumprecht: Die Technik der Spez. Therapie, p. 386, 1906.
22. Caillé: Differential Diagnosis and Treatment of Disease, p. 135, 1906.
23. Abrams: Medical News, Apr. 13, 1895.
24. Abrams: Medical Record, Sept. 8, 1900.
25. Abrams: American Medicine, Jan. 3, 1903.
26. Favill: International Clinics, vol. i, 1904.
27. Hamilton: Medical Record, Dec. 3, 1904.
28. Dana: American Medicine, Jan. 21, 1905.
29. Kemp: Medical News, July 8, 1905.
30. Horoszkiewicz and Marx: Berlin. klin. Woch., Aug. 27, 1906.
31. Abrams: Transact. Cal. State Med. Soc., Apr. 21, 1901.
32. Jeanselme: Revue de Méd., p. 502, 1892.
33. Brown and Osgood: Amer. Journ. of Surgery, April, 1905.
34. Winkler and Stein: Centralbl. f. inn. Med., No. 33, 1899.
35. Bramwell: Clinical Studies, vol. ii, p. 350, 1904.
36. Sahli: Diagnostic Methods, 1906.
37. Oppenheim: Diseases of the Nervous System, p. 661.
38. Hare: Practical Therapeutics, p. 189, 1902.
39. Koller: Ref. Handbook of the Med. Sciences, vol. iii, p. 158.
40. Bertram: Medizin. Klinik, Apr. 9, 1905.
41. Reiss: Therapie der Gegenwart, No. 10, p. 458, 1905.
42. Severino: Semaine Médicale, xxvi, No. 16, 1906.
43. Fisher: Münch. med. Woch., No. 14, 1904.

44. SAHLI: Correspondenzblatt f. Schweitzerärzte, Nos. 8 and 9, 1905.
45. EINHORN: Journ. Amer. Med. Assoc., May 12, 1906.
46. MONOD: Journ. de Physiol. et de Path. gen., vol. viii, p. 853, 1906.
47. MCCRAE: Journ. Amer. Med. Assoc., xlii, p. 8, 94, 161, 1904.
48. CLARK: Amer. Journ. of the Med. Sciences, Sept., 1906.
49. STRASSBURGER: Zeitschrift f. klin. Med., vol. 46, p. 434, 1902.
50. MACCALLUM: Univers. of Cal. Public., vol. i, Nos. 10, 13, 14.
51. CROFTAN: Journ. Amer. Med. Assoc., June 24, 1905.
52. COMBE: L'auto-intoxication Intestinale, 1907.
53. SIMIONESCU: Archiv. gén. de Méd., Aug. 7, 1906.
54. ALEXANDER: Zentralbl. f. die Krankheiten d. Harn- u. Sexualorgane, No. 4, 1905.
55. MCCLINTOCK and KING: Journal of Infect. Dis., Oct. 30, 1906.
56. ROST: British Med. Journal, No. 2302, p. 294, 1905.
57. STERN: American Medicine, May, 1901.
58. ABRAMS: Phila. Med. Journal, Aug. 12, 1899.
59. GRANT: London Lancet, Dec. 31, 1904.
60. RICHARDSON: Therapeutic Gazette, Jan. 15, 1907.
61. ABRAMS: Amer. Journ. of the Med. Sciences, Jan., 1904.
62. ABRAMS: Medical Record, Sept. 16, 1905; Medicine, Jan., 1904; American Medicine, Apr. 2, 1904, July 16 and April 22, 1904.
63. SHARPE: British Med. Journal, No. 2316, p. 1089, 1905.
64. ABRAMS: The Medical News, Jan. 25, 1904.
65. SALAMON: Verhand. d. Kongr. f. inn. Med., p. 244, 1902.
66. ROYSTER: Journ. Amer. Med. Assoc., p. iii, July 14, 1906.
67. MARTINET: Les Medicaments Usuels, p. 258, 1906.
68. CAMPO: New York Med. Journal, Aug. 15, 1903.
69. BENEDICT: Internat. Med. Magazine, June, 1903.
70. REED: Diseases of the Stomach and Intestine, p. 133, 1904.
71. The Lancet, vol. i, pages 645, 739, 1906.
72. ROSS: The Lancet, Jan. 20, 1906.
73. KRAUS: Discuss. Berlin. Med. Soc., La Presse Méd., Jan. 30, 1907.
74. ABRAMS: American Medicine, Feb. 15, 1902.
75. ABRAMS: Amer. Journ. of the Med. Sciences, Nov., 1904.
76. ABRAMS: Splanchnic Neurasthenia, 2d ed., 1906.
77. ABRAMS: Medical Record, Jan. 5, 1901; American Med., Jan. 3, 1903.
78. ABRAMS: The Lancet, p. 1685, Dec. 15, 1906.
79. ABRAMS: Medical Record, Dec. 7, 1901.
80. HARE: The Clin. Journal, London, Aug. 29, 1906.
81. RINGUEBURG: New York Med. Journ., June 30, 1906.
82. HIRSCHFELDER: Bulletin of the Johns Hopkins Hos., p. 339, vol. 17.
83. JULLIEN: Annales de la polyclin. centr. de Brux., March, 1906.
84. GOSSIO: Zeitschr. f. Hyg. u. Infektionskr., vol. 51, pp. 65–125, 1905.
85. STERN: Transact. Manhattan Clinical Society, 1904.
86. BIAL: Verhand. d. Kongr. f. inn. Med., pp. 521–523, 1897.
87. QUINCKE: Therapie der Gegenwart., xliv, 1905.
88. WOLBARST: Medical Record, Apr. 21, 1906.
89. ABRAMS: Phila. Med. Journal, March, 1899.
90. DEXTER: Weather Influences, 1904.
91. WAGNER: American Journal of Insanity, Oct., 1904.

92. JACKSONTAYLOR: The Lancet, March 23, 1907.
93. HABERMAN: Medical Record, June 16, 1906.
94. SERGENT: Presse Médicale, Nov. 25, 1903.
95. WIDAL and JAVAL: Presse Médicale, June 29, 1903.
96. LEUBE: Special Med. Diagnosis, p. 279, 1904.
97. COHN: Electro-Diagnosis and Electro-Therapeutics, p. 199, 1904.
98. ABRAMS: American Medico-Surgical Bulletin, Dec. 15, 1895.
99. ABRAMS: American Journal of the Med. Sciences, Jan., 1904.
100. ABRAMS: Phila. Med. Journ., Sept., 1891; Medicine, Dec., 1895; New York Med. Journ., June 13, 1896; Phila. Med. Jour., Jan. 6, 1900.
101. ABRAMS: Medical Record, Apr. 28, 1899.
102. ABRAMS: New York Med. Journal, June 13, 1900.
103. MOCCUCCI: Riforma Medica, p. 208, 1898.
104. ABRAMS: Medical Record, Jan. 5, 1901.
105. ABRAMS: N. Y. Med. Journ., Jan. 13, 1900; Med. News, Jan. 7, 1899.
106. KINGSCOTE: Asthma, Recent Development and its Treatment.
107. LOOMIS: Medical Record, Dec. 10, 1898.
108. CAMPBELL: Respiratory Exercises, p. 170.
109. OSLER: Practice of Medicine, p. 571.
110. ABRAMS: Diseases of the Heart, p. 81.
111. QUIMBY: Boston Med. and Surg. Journal, Aug. 31, 1899.
112. ABRAMS: La Presse Médicale, Feb. 6, 1907.
113. STILLER: Wiener med. Woch., 15, 1902.
114. LITTEN: Deutsch. med. Woch., No. 13, 1892.
115. CABOT: Physical Diagnosis, p. 23, 1900.
116. SAHLI: Untersuchungs Methoden, p. 65, 1902.
117. LERMOYEZ: France Médicale, p. 641, 1891.
118. WILLIAMS: The Röntgen Rays in Medicine.
119. ABRAMS: American Medicine, Feb. 15, 1902.
120. WEST: Diseases of the Organs of Respiration, vol. i, p. 223.
121. NEISSER and SIEBERT: Medizin. Klinik., No. 1, 1905.
122. ABRAMS: Manual of Clinical Diagnosis, p. 50.
123. BRUEN: Pocket-book of Physical Diagnosis.
124. PERSHING: Journ. Amer. Med. Assoc., Jan. 30, 1904.
125 STRASSER: Braun's Ther. der Herzkrank., p. 118, 1903.
126. KEMP: Enteroclysis, Hypodermoclysis and Infusion.
127. CLUBBE: British Med. Journal, Jan. 17, 1905.
128. COLE: Intercol. Med. Journal of Australia, Nov. and Dec., 1904.
129. KNAPP: Med. News, June 10, 1905.
130. DOWSE: Treatment by Physical Methods, 1903.
131. ARNOLD: Internat. Med. Journal, May, July, Aug., 1903.
132. SAVIDGE: Medical Record, 1905.
133. LOEB: Journ. of the Amer. Med. Assoc., Jan. 16, 1904.
134. PATRICK: Journ. Amer. Med. Assoc., Jan. 30, 1904.
135. NEFF: Medicine, Nov., 1904.
136. SCHOFIELD: The Force of Mind, p. 216, 1903.
137. BRIQUET: Traité de l'Hysterie, 1859.
138. HECHT: Journ. Amer. Med. Assoc., Feb. 23, 1907.
139. BRUNS: Die Hysterie im Kindesalte, Monograph, 1906.
140. JACOBY: System of Physiolog. Ther., p. 169, vol. ii.

141. Reuss: Vierordt's Daten u. Tabellen, 1888.
142. Jackson: Journ. Amer. Med. Assoc., March 30, 1907.
143. Koplik: Med. Record, Sept. 29, 1906; Jour. Am. Med. Assoc., Apr. 6, 1907.
144. London: Berlin. klin. Woch., No. 42, 1905.
145. Bordièr: Archiv. Röntgen Ray, June, 1906.
146. Abrams: N. Y. Med. Journal, Jan. 3, 1903.
147. Abrams: Med. News, Aug. 22, 1903.
148. Abrams: American Medicine, Jan. 3, 1903.
149. Schwarz: Münch. med. Woch., Jan. 16, 1906.
150. Hall-Edwards: Archiv. of the Röntgen Ray, Sept., 1906.
151. Hoffa: Berlin. klin. Woch., xliii, No. 27, 1906.
152. Horand: La Presse Médicale, No. 102, 1906.
153. Cushing: Journ. Nerv. and Mental Diseases, Nov., 1902.
154. Moskowicz: La Semaine Médicale, Oct. 17, 1906.
155. Gerhardt: Münch. med. Woch., liii, No. 26, 1906.
156. Giles: Gynecological Diagnosis, 1906.
157. Berillon: Treatment, June, 1906 (annotated by Bailey).
158. Link: Zeitschrift f. klin. Med., vol. 59, Nos. 23, 24, 1906.
159. Sondermann: Münch. med. Woch., No. 1, 1905.
160. Spiess: Archiv. f. Laryngol., p. 179, 1905.
161. Ritter: Deutsch. med. Woch., xxxii, No. 30, 1906; J. A. M. A., Sept. 22, 1906.
162. Abrams: American Med., July 16, 1904.
163. Lewis: Journ. Mental Sciences, Apr., 1906.
164. Reichardt: Neurolog. Centralbl., June 16, 1906.
165. Cazin and Gros: Med. Press, Sept. 30, 1903.
166. Sherren: Lancet, Sept. 19, 1903.
167. Jonkowski: The Med. Annual, p. 550, 1907.
168. Comby: Archiv. Ped., July, 1906.
169. Wilson: Archiv. Ped., Jan., 1905.
170. Williams: Med. Record, July 14, 1906.
171. Potter: Med. Record, June 2, 1906.
172. Mayer: Cal. State Jour. of Medicine, July, 1906.
173. Finkelnburg: Münch. med Woch., No. 9, 1906.
174. Grünbaum: British Med. Journal, Apr. 27, 1907.
175. Voelcker: The Diagnosis of Surgical Diseases of the Kidney by Chromocystoscopy, 1906.
176. Vollicher and Joseph: Münch. med. Woch., p. 2028, 1903; Deutsch. med. Woch., p. 536, 1904.
177. Mendelsohn: Verhand. d. 19. Kongr. f. inn. Med.
178. Herz: Deutsch. med. Woch., Jan. 31, 1905.
179. Heitler: Braun's Ther. der Herzkrankh., p. 31, 1903.
180. Abrams: The Amer. Jour. of the Med. Sciences, Jan., 1904.
181. Abrams: N. Y. Med. Journal, Oct. 18, 1902.
182. Abrams: The Phila. Med. Journal, Sept. 29, 1900.
183. Abrams: Amer. Journ. of the Med. Sciences, Nov., 1904.
184. Marchand: Archiv. Gén. de Méd., lxxxvii, p. 192, 1907.
185. Abrams: The Phila. Med. Journal, Feb. 25, 1899.
186. Chauffard: Traité de path. gén. de Bouchard, vol. v, p. 55.
187. Walker: The Lancet, March 16, 1907.

188. ALBARRAN: Exploration des Fonctions Renales, 1905.
189. BRAMWELL: Lancet, i, p. 725, 1904.
190. ABRAMS: Phila. Med. Journal, Aug. 12, 1899.
191. ABRAMS: American Medicine, Sept. 30, 1905.
192. BOAS: Centralbl. f. klin. Med., vol. x, 1889, No. 6, p. 97; Zeitschrift f. klin. Med., 1890, vol. xvii, p. 155.
193. SCHMIDT: The Test Diet in Intestinal Diseases, 1906.
194. BLUMER: Albany Med. Annals, Apr., 1905.
195. SIMON: Journ. Amer. Med. Assoc., Nov. 24, 1906.
196. REMOND and VOIVENEL: Le Progrès Méd., June 1 1907.
197. MARIE: Semaine Médicale, May 23, 1906.
198. CORNING: Journ. Amer. Med. Assoc., May 6, 1905.
199. CALMETTE: La Presse Médicale, June 19, 1907.
200. CRAMPTON: The Medical News, Sept. 16, 1905.
201. MCWILLIAMS: Medical Record, Dec. 16, 1905.
202. JACOBSON: Medical Record, March 31, 1906.
203. HEITZ: La Presse Médicale, June 19, 1907.
204. DAVIS: Journ. of the Amer. Med. Assoc., June 7, 1902.
205. TOULOUSE: Paris Soc. de Thér., June 22, 1904.
206. DESPLATS: Archiv. Méd. Belg., Feb., 1905.
207. CLEMENT: Lyon Méd., No. 8, 1905.
208. ICARD: Journal des Praticiens, No. 15, 1905.
209. STRZYZOWSKI: Therapeut. Monatshefte, No. 2, 1905.
210. FREY: Münch. med. Wochenschrift, No. 28, 1905.
211. DENNING and WATSON: Lancet, Oct. 14, 1906.
212. WRIGHT and PARRAMORE: Lancet, Oct. 14, 1906.
213. ABRAM, MOORE, EDIE: Lancet, Feb. 15, 1906.
214. MOULINIER: Semaine Méd., Jan. 10, 1906.
215. MACVICAR: S. Afr. Med. Record, Apr. 25, 1906.
216. KOLACZEK and MÜLLER: Deutsch. med. Woch., No. 17, 1907.
217. BALLENGER: Journ. Amer. Med. Assoc., June 8, 1907.
218. BEER: Journ. Amer. Med. Assoc., June 8, 1907.
219. STORCK: Journal American Med. Assoc., June 8, 1907.
220. EDSALL and PEMBERTON: Amer. Journ. of the Med. Sciences, March, 1907.
221. FALES: American Journal of the Med. Sciences, April, 1907.
222. LOOPER and BOVERI: La Presse Médicale, June 5, 1907.
223. GORDON: Medicine, Dec., 1906.
224. LICHTENSTEIN: Münch. med. Woch., March 13, 1906; Med. Record, April 7, 1906.
225. STARR: Monthly Cyclopedia of Pract. Med., May, 1906.
226. LEDUC: La Province Méd., No. 1, 1907.
227. MÉRIEUX: Journ. Amer. Med. Assoc., Aug. 4, 1906.
228. BLUME: Berlin. klin. Woch., Aug. 21, 1905.
229. TURCK: Journ. Amer. Med. Assoc., June 9, 1906.
230. GRAWITZ: Medical Record, March 9, 1907.
231. DAWBARN: Journ. Amer. Med. Assoc., Aug. 21, 1906.
232. ZEBROWSKI: Deutsch. med. Wochen., Sept. 7, 1905.
233. FRIEDENBERG: Medical Record, March 3, 1906.
234. PARSONS: The Lancet, Sept. 30, 1905.
235. HEATH: Journ. Amer. Med. Assoc., Oct. 20, 1906.

236. Lederer: Prager med. Wochen., xxxii, No. 90, 1907.
237. Kast and Meltzer: Medical Record, Dec. 29, 1906.
238. Levy: Zeitschrift f. klin. Med., Bd. 60, Heft 1 and 2, 1906.
239. Sabouraud: Bulletin. gén. de Therapeutique, Nov. 30, 1906.
240. Carstens: Journ. Amer. Med. Assoc., Dec. 29, 1906.
241. Bossi: Centralbl. f. Gynäkol., xxxi, No. 3, 1906.
242. Carleton: American Medicine, Feb. 24, 1906.
243. Bernicot: Journ. of Path. and Bacteriology, xi, 304, 1906.
244. Lots: Therapeut. Monatsh., No. 3, 1906.
245. Schreiber: Zeitschr. f. klin. Med., vol. 55, No. 3, 1906; Med. Record, Aug. 25, 1906.
246. Brönnum: Journ. Amer. Med. Assoc., March 9, 1907.
247. Le Fur: Xe Congrès de L'association Française d'Urologie, Paris, Oct. 4–6, 1906.
248. Wolf-Eisner: Centralbl. f. Bakt., Bd. xl, p. 634, 1906; J. Med. Sc., Sept., 1906.
249. Cowie: American Medicine, Jan., 1907.
250. Hollis and Ditman: Medical Record, Feb. 2, 1907.
251. Peabody: Medical Record, March 9, 1907.
252. Slovstoff: Ruskü Vrach., No. 7, 1906.
253. Roberts: N. Y. State Med. Jour., Jan., 1907; Therap. Gazette, March 15, 1907.
254. Moynihan: Edinburgh Med. Journal, May 1, 1906.
255. The Medical Press, Oct. 3, 1906.
256. Tuszkai: Volkmann's Sammlung klin. Vorträge. .
257. Sicard: Medical Record, May 15, 1906.
258. Elmer: N. Y. Med. Journal, Feb. 3, 1906.
259. Nutt: Jour. Amer. Med. Assoc., Jan. 19, 1907.
260. Lawrie: The Lancet, Oct. 20, 1906.
261. Epstein: N. Y. Med. Journ., May 26, 1906.
262. Appleman: The Therapeutic Gazette, Apr. 15, 1907.
263. Tucker: The Therapeutic Gazette, Apr. 15, 1907.
264. House: Medical Sentinel, March, 1906.
265. Ascoli: Berlin. klin. Woch., Dec. 7, 1906.
266. Plesch: Deutsch. med. Woch., May 3, 1906.
267. Bruck: Med. Klinik, Feb. 3, 1907.
268. Coppioli: Riforma Med., Apr. 13, 1907.
269. Levi and de Rothschild: Paris Société Méd. des Hôp., May 11, 1906.
270. Roberts: Journ. Amer. Med. Assoc., July 28, 1906.
271. Netter: Compt. rend. Soc. de biolog., vol. lx, p. 278, 1906.
272. Landolfi: Journal Amer. Med. Assoc., Aug. 18, 1906.
273. Sellheim: Centralbl. f. Gynäkol., xxx, No. 4; J. A. M. A., May 19, 1906.
274. Lesem: Medical Record, Sept. 1, 1906.
275. Bloomfield: Medical Record, Sept. 1, 1906.
276. Parker: Medical Record, Feb. 9, 1907.
277. Wadsworth: Journ. of Infect. Diseases, Oct. 30, 1906.
278. McDonald: Journ. Amer. Med. Assoc., Dec. 15, 1906.
279. Hasselbach: Medical Record, April 28, 1906.
280. Bishop: Journ. A. M. A., Nov. 24, 1906.
281. Gradle: Journ. A. M. A., Nov. 24, 1906.

282. Morton: Medical Record Nov. 18, 1905.
283. Croom: Edinburgh Med. Journal, Oct., 1906.
284. Beutter: La Presse Méd., Sept. 23, 1905; Med. Record, Nov. 4, 1905.
285. Bagby: Journ. Amer. Med. Assoc., Jan. 26, 1907.
286. McGuire: Medical Record, Jan. 19, 1907.
287. Turner: The Practitioner, April, 1906.
288. Morris: The Practitioner, April, 1906.
289. Valobra: Medical Record, Sept. 16, 1905.
290. Carothers: Medical Record, Jan. 19, 1907.
291. Voelcker and Lichtenberg: Münch. med. Wochen., Jan. 16, 1906; Medical Record, Feb. 10, 1906.
292. Thompson: Medical Record, Apr. 13, 1907.
293. Wood: Medical Record, April 13, 1907.
294. Lobenstine and Harrar: Bulletin of the Lying-in Hospital, Dec., 1906.
295. Ladinski: Medical Record, April 13, 1907.
296. Langstein: Berlin. klin. Wochen., Jan. 28, 1907.
297. Löwy: Neurolog. Zentralbl., No. 20, 1906.
298. Kilmer: Archiv. of Ped., Feb., 1907.
299. Stepp: Therapeut. Monatsh., Nov., 1904.
300. Williamson: The Practitioner, Apr., 1906.
301. Buisch: Archiv. f. Gynäkol., Bd. 79, Heft 2, 1906.
302. Jefinow: Klin. ther. Woch., No. 2, 1907.
303. Blumgart: Medical Record, April 6, 1907.
304. Guthrie: The Clinical Journal, London, June 12, 1907.
305. Von Pirquet: Berlin. klin. Woch., May 20, 1907.
306. Valée: Compt. rend. Acad. Sciences, 144, 1243, 1907.
307. Laspeyres: Med. Klinik, May 26, 1907.
308. Williamson: The Lancet, June 29, 1907.
309. Davis: Therapeut. Gazette, July 15, 1907.
310. Venable: Virginia Med. Monthly, Feb. 22, 1907.
311. Schlesinger and Holst: Münch. med. Woch., March 5, 1907; Med. Record, Apr. 6, 1907.
312. Abrams: Medicine, Jan., 1904.
313. Meltzer and Auer: Medical Record, Dec. 16, 1905.
314. Bock: Berlin. klin. Woch., No. 23, 1900.
315. Abrams: N. Y. Med. Journal, Oct. 18, 1902.
316. Chlumsky: Zentralbl. für Chirurg., No. 33, 1905.
317. Williamson: British Med. Journ., July 20, 1907.
318. Rotch and Floyd: Journ. Amer. Med. Assoc., Aug. 24, 1907.
319. Meyers: Journ. Amer. Med. Assoc., Aug. 24, 1907.
320. British Med. Journal, vol. i, p. 16, 1905.
321. White: Journ. Amer. Med. Assoc., Aug. 31, 1907.
322. Nyrop: Journ. Amer. Med. Assoc., Aug. 31, 1907.
323. Kapp: Therapeut. Monatsh., March, 1907.
324. Valentine and Townsend: Medical Record, June 29, 1907.
325. Minor: Berlin. klin. Woch., May 6, 1907.
326. Gebrovsky and Guilévitch: Russk. Vratch, May 2, 1907.
327. Pitzman: Journ. Amer. Med. Assoc., Sept. 7, 1907.
328. Goldscheider: Deutsch. med. Woch., July 11, 1907; Journal A. M. A., Sept. 21, 1907.

329. Ferrand and Lemaire: La Presse Médicale, Sept. 28, 1907.
330. Grunmach: Ueber die Bedeutung der Roentgenstrahlen für die Diagnostik.
331. Hirschlaff: Hypnotismus u. Suggestivtherapie, 1905.
332. Miles: Journ. Amer. Med. Assoc., Oct. 5, 1907.
333. Horne: The British Med. Journal, Oct. 2, 1907.
334. Kocher: Journ. Amer. Med. Assoc., Oct. 12, 1907.
335. Gennari: Rif. Med., No. 11, 1907.
336. Smith: The British Med. Journal, July 20, 1907.
337. Williamson: The British Med. Journal, July 20, 1907.
338. Bial: Berlin. klin. Woch., No. 226, Apr., 1907; B. Med. J., July 22, 1907.
339. Polano: München. med. Wochen., No. 35, 1907.
340. Hall: Boston Med. and Surg. Journ., Jan. 17, 1905.
341. Pershing: Journ. Amer. Med. Assoc., Jan. 30, 1904.
342. Bock: Berlin. klin. Wochenschrift, June 4, 1900.
343. Frenkel: English translation by P. Blakiston's Son and Co.
344. Ferreira: La Presse Médicale, Sept. 21, 1907.
345. Schanz: Zeitschrift f. orthoped. Chirurg., vol. xix, p. 115, 1907.
346. Journal of the American Med. Assoc., Oct. 26, 1907.
347. Rovsing: Centralbl. f. Chirurg., No. 43, 1907.
348. Vincent: Société Médicale des Hôpitaux, Nov. 22, 1907.
349. Lasinski: Medizin. Klinik, June 9, 1907.
350. Rénon: La Presse Méd., Nov. 23, 1907.
351. Warthin: Amer. Jour. of Med. Sc., May, 1907.
352. Tuffier and Aubourg: La Presse Méd., Dec. 11, 1907.
353. Weinbrenner: Münch. med. Woch., No. 40, 1907; Jour. A. M. A., Nov 9, 1907.
354. Einhorn: Münch. med. Woch., No. 27, 1907.
355. Loewi: Wiener klin. Woch., June 20, 1907.
356. Hertaghe: Bull. de l'Acad. Royale de Méd. Belg., April 27, 1907.
357. Lindenheim: Berl. klin. Woch., March 18, 1907.
358. Marfan: Revue de Méd., Nov. 10, 1907.
359. Rovsing: Zentralbl. f. Chirurg., No. 43, 1907.
360. James: British Med. Journ., Dec. 28, 1907.
361. Metchnikoff: Annal. de l'Institut. Pasteur, Oct., 1907.
362. Broca: La Presse Méd., Jan. 1, 1908.
363. Herschell: Folia Therapeut., July, 1907.
364. Ochsner: Clinical Surgery, 1905.
365. Abrams: Diseases of the Lungs.
366. Von Noorden: Medizin. Klinik, Jan. 5, 1908.
367. Schieffer: Deutsch. Archiv. f. klin. Med., vol. xcii, 1907.
368. Huchard: Journ. des Pratic., July 27, 1907.
369. Haig: Medical Record, Dec. 21, 1907.
370. Glaessner: Wien. med. Woch., lvii, 1034, 1907.
371. Wernigk: Journal A. M. A., Feb. 22, 1908.
372. Klausner: Wien. klin. Woch., Feb. 13, 1908.
373. Cowie: American Med., Jan., 1907.
374. Jackson: Med. Record, April 6, 1907.
375. Stengel and Pancoast: Journal A. M. A., April 25, 1908.
376. Janet: The Major Symptoms of Hysteria, 1907.
377. Goldthwait: Bost. Med. and Surg. Journ., vol. 152, 1905.

378. **Herter**: Journal A. M. A., June 13, 1908.
379. **Beevor**: Journal A. M. A., July 11, 1908.
380. **Butler**: Medical Record, Feb. 1, 1908.
381. **Flexner**: Boston Med. and Surg. Jour., Feb. 19, 1908.
382. **Irons**: Jour. of Infectious Dis., v, 279, 1908.
383. **Gunn**: British Med. Jour., July 18, 1908.
384. **Marshall**: Jour. A. M. A., Sept. 12, 1908.
385. **Fliess**: Gesellschaft f. Geburtshilfe zu Berlin, Feb. 28, 1898.
386. **Siegmund**: Münch. med. Wochen., Aug. 4, 1908.
387. **Crowe**: Johns Hopkins Bull., March, 1908.
388. **Stevenson**: Med. Record, May 16, 1908.
389. **Heitz**: Lyon Médic., Dec. 3, 1905.
390. **Hempel**: Berlin. klin. Woch., Sept. 28, 1908.

INDEX.

A.

Abdominal compressor, 770
  " insufficiency, 408
  " palpation, 208
  " supporters, 407
  " tumors, 534
Abortion, from drugs, 89
Abscess, fixation, 366
  " tuberculous, 611
Acarus scabiei, 356
Accommodation, 973
Acetanilid, in etiology, 44
Acetonuria, 58, 119
Achylia gastrica, 198, 312
Acid, boric, in diagnosis, 387
  " " in etiology, 45
  " carbolic, in etiology, 45
  " chromic, in diagnosis, 392
  " citric, in diagnosis, 393
  " hydrobromic, 385
  " hydrochloric, in diagnosis, 312
  " " tests for, 863
  " hydrocyanic, in etiology, 46
  " intoxication, 59
  " tartaric, in diagnosis, 406
  " toxicodendric in diagnosis, 402
Aconite, in diagnosis, 386
  " in etiology, 46
Acoria, 132
Acroparesthesia, 925
Actinomycosis, iodids in, 192
Acupuncture, 413
Addison's disease, 338
Adenoids, 700, 805
Adhesions, perigastric, 465
Adrenal glands, 343
Adrenalin, 336
  " in anesthesia, 62
  " in diagnosis, 337
  " in etiology, 84
Age, in diagnosis, 11
Agglutination test, 286
Air-pump, in diagnosis, 551, 553
Albarran's test, 842
Albuminorrhea, 882
Albuminuria, 831
  " accidental, 423
  " conclusions concerning, 328
Albuminuria, experimental, 831
  " Faradic, 472
  " from drugs, 93
  " from food, 141
  " functional, 833
  " in lung-diseases, 805
  " orthostatic, 327, 834
  " physiologic, 833
  " renal, 832
  " without renal lesions, 832
Albumoses, 367
Alcohol in etiology, 46, 681
Alcoholic delirium, 682
Alcoholics, Anstie's rule for, 682
Alcoholism, chronic, 47
Alkaptonuria, 142
Alopecia, 814
Amaurosis, 967
Amblyopia, 967
Ammonia, in diagnosis, 386
Amyl nitrite, in diagnosis, 370
Analgesics, in diagnosis, 203
Anaphrodisiacs, 229
Anemia, arsenic in, 185
  " blood in, 881
  " cardiac murmurs in, 365
  " diagnosis of, 362
  " from drugs, 89
  " heart-murmurs in, 767
  " pernicious, 557, 883
  " primary, 882
  " pulmonary, 363
  " rheumatic, 255
  " splenic, 884
  " symptoms of, 364
Anesthesia, in diagnosis, 212, 229
  " medullary, 172
  " mortality from, 61
  " paralysis from, 58
  " table of symptoms, 61
Anesthetics, in diagnosis, 207
  " table of, 213
Angina Ludovici, 730
  " pectoris, blood-pressure in, 785
  " " diagnosis of, 753
Ankylosis, chloroform in diagnosis of, 210
Ankylostomiasis, 111
  " diagnosis of, 240
Antacids, gastric, 321

Anthelmintics, in diagnosis, 212
" in etiology, 47
Anticonvulsants, in diagnosis, 233
Antimalarials, 241
Antimony, in etiology, 48
Antineuralgics, 248
Antipyretic treatment, 32
Antipyrin, 215
" in diagnosis, 249, 252
" in etiology, 47
Antirheumatics, in diagnosis, 253
Antiseptics, in diagnosis, 257
Antitoxin, in etiology, 49
Aorta, thoracic, 791
" tracings of, 791
Aortic reflexes, 633
Apex-beat, 758
Aphasia, test for, 682
Aphonia, hysterical, 210
Aphrodisiacs, in diagnosis, 229
Apomorphin, in diagnosis of bulbar paralysis, 986
" in etiology, 50
Apoplectic habitus, 415
Appendicitis, blood in, 888
" from food, 124
" in etiology, 683
" pseudo, 602
Appendicular colic, 686
Aprosexia, 82
Argyll-Robertson pupil, 970
Argyria, 82
Argyrol, in diagnosis, 386
Arnica, in etiology, 50
Arrhythmia, 757
Arsenic, in diagnosis, 185
" in etiology, 51
" in malaria, 243
Arterial insufficiency, 787
" occlusion, 651
Arteriosclerosis, and adrenalin, 815
" and hypertension, 788
" blood-pressure in, 782
" caused by drugs, 89
" grades of, 378
" hydrotherapy in, 542
" iodids in, 196
" *x*-ray examination in, 646
Arteriosclerotic colic, 317, 380
Arthralgia, psycho-neurotic, 720
Arthritis deformans, from food, 117
Aspiration, parenchymatous, 176
Aspirator of Kuttner, 164
Aspirin, in diagnosis, 257
Asthenopia, 975
Asthma, adrenalin in, 337
" amyl nitrite in, 383
" atropin in, 301
" cardiac, 754
" caused by food, 137
Asthma, climate in, 428
" cocain in diagnosis of, 216
" dyspeptic, 321
" exercises in, 510
" heart in, 501
" nasal, 341
" sprays for, 217
" *x*-ray examination in, 625
Astigmatism, 975
Ataxia, table of, 915
" tests for, 914
Atelectatic zones, 488
Athetoid movements, 913
Atmospheric pressure, 16
Atoxyl, 187
Atropin, in constipation, 299
" in diagnosis, 296
" test in bradycardia, 300
Auditory nerve, lesions of, 981
Autointoxication, diet in, 454
" intestinal, 258
" sinusoidal current in, 476
Auto-sero prognosis, 617

B.

Babinski reflex, 595, 718
Bacillus of Boas-Oppler, 857
Bacteriotherapeutic methods, 262
Bandage, in diagnosis, 650
" in respiratory diseases, 655
Banti's disease, 884
Barometric neuroses, 16
Baruch's sign, 541
Baths, artificial Nauheim, 484
" carbonated, in acute infections, 33
Beevor's sign, 717
Belladonna, in diagnosis, 296
" in etiology, 51
Bell's mania, 950
Benzidin test, 449
Benzin, 357
Beriberi, 114
Bibliography, 1015
Bile pigments, tests for, 92
Bilharziosis, 108
Biliousness, 293
Bismuth, in diagnosis, 261, 325
" in etiology, 53
Bladder, functions of, 419
" inflation of, 551
" motor re-education of, 992
" neuroses of, 420
" *x*-ray examination of, 644
Blood, coagulability of, 325
" coagulation of, 151
" color-index of, 899
" counting cells of, 895

Blood, in icterus, 902
  “ in plumbism, 902
  “ pathological physiology of, 881
  “ physiology of, 879
  “ tests for sufficiency of, 893
  “ tubercle bacilli in, 901
  “ volume of, 781
Blood-letting, in diagnosis, 414, 416
  “ in etiology, 150
  “ physiology of, 416
Blood-pressure, 371
  “ action of drugs on, 782, 784
  “ diagnosis by, 236
  “ in arterial sufficiency, 787
  “ in disease, 782
  “ normal, 781
  “ postural variations of, 999
Blood-vessels, pathological physiology, of, 780
  “ physiology of, 779
Blum's sign, 727
Boas-Oppler bacillus, 857
Bones, *x*-ray examination of, 647
Borax, in diagnosis, 235
Botulism, 105
Bradycardia, 756
  “ from drugs, 89
Brain, hyperemia of, 908
  “ increased pressure of, 909
  “ tests for sufficiency of, 937
Bromids, in diagnosis, 233
  “ in etiology, 52
Bromipin, 234
Bromism, 234
Bromoform, in etiology, 52
Bromatoxism, 105
Bronchial muscle, 500
  “ phthisis, 624
Bronchitis, exercises in, 509
Bronchopneumonia, exercises in, 509
  “ from food, 138
Bronchostenosis, spasmodic, 383
Brunton's rule, 27
Bullet-probe, 662
Butyl-chloral, 249

C.

Caffein, in etiology, 53
Calomelol ointment, 199
Calorimetry, 252
Cammidge reaction, 849
Cannabis indica, in etiology, 53
Cantharides, in etiology, 54
Carboluria, 45
Carbonic acid, in etiology, 87
Cardiac spasm, 853
Cardiopaths, rules for, 145
Cardio-splanchnic phenomenon, 769
Carminatives, in diagnosis, 289
Casts, 835
Cathartics, in diagnosis, 289
  “ in etiology, 54
Catheter life, 154
Catheterization, in etiology, 153
Cephalometry, 1010
Cestodes, 107
Chest, *x*-ray examination of, 620, 636
Child, mensuration of, in uterus, 1010
Childhood, diseases of, 725
Chloral, in etiology, 56
Chloralamid, in etiology, 56
Chloroform, in diagnosis, 207
Chlorosis, arsenic in, 186
  “ blood in, 882
  “ diagnosis of, 260, 293
  “ diet in, 149
  “ iron in, 365
  “ lavage in, 560
Choked disc, 909
Cholelithiasis, 389
  “ from food, 125
Cholemia, 294, 824
Chologen, in diagnosis, 389
Chorea, arsenic in, 186
Choreic movements, table of, 916
Chromic acid, 392
Chromocystoscopy, 243
Chromo-diagnosis, 37
Chrysarobin, in diagnosis, 196
Circulation, pathology of, 415
Circulatory stimulants, in diagnosis, 301
Cocain, for avoiding reflexes, 60
  “ in diagnosis, 212
  “ in etiology, 63
  “ intoxication from, 212
Codein, in diagnosis, 207
Colchicum, in diagnosis, 188
  “ in etiology, 64
Colic, appendicular, 686
  “ arteriosclerotic, 317, 380
Collapse, 785
Collargol, in diagnosis, 393
Collodion, in diagnosis, 358
Colonic impaction, 260
Coma, diabetic, 119
Compensation, broken, 752
Condition, test of, 998
Congestion, intracranial, 417
  “ local, 418
Conjunctivitis, 340
Consciousness, clouding of, 941
Constipation, from food, 127
  “ from ptosis, 412
  “ massage for, 128
  “ oil in, 396
  “ test for, 290
  “ varieties of, 292

Contractures, 719, 913, 917
“ bandage in diagnosis of, 651
“ chloroform in diagnosis of, 209
Convallaria, 307
Copaiba, in etiology, 65
Copper, in etiology, 65
Copremia, 293
Corrosive sublimate, 75
Coto, 259
Coughs, diagnosis of, 226, 246, 297, 311
Counterirritants, in diagnosis, 307
Courvoisier, law of, 819
Cowling's rule, 27
Creosote, in diagnosis, 263
“ in etiology, 65
Cretinism, 349, 734, 950
Cryoscopy, 837
Cyanosis, from drugs, 89
“ enterogenic, 559
Cycloplegia, 969

D.

Deafness, nervous, 982
Death, determination of, 394, 650
Degeneration, reaction of, 469
Delirium, acute, 950
“ alcoholic, 682
Delusions, 942
Dementia præcox, 946
Dental caries, diagnosis of, 197
Dermatol, in diagnosis, 263
Deutschmann's serum, 275
Diabetes, adrenalin in diagnosis of, 341
“ blood in, 247
“ coma of, 119, 324, 800
“ etiologic-diagnosis of, 442
“ experimental, 818
“ from drugs, 90
“ from food, 117
“ opium in diagnosis of, 206
“ pancreatic, 118, 850
“ phosphatic, 119
“ renal, 119
“ test of severity of, 395
Diagnosis, 1
“ chromo, 37
“ etiologic, 5
“ incompleteness of, 8
“ mistakes in, 2
“ occupational, 13
Diaphoretics, in diagnosis, 309
Diarrhea, from food, 129, 130
“ in etiology, 689
Diathesis, apoplectic, 707
“ exudative, 707
Diathesis, gouty, 707
“ hemorrhagic, 709
“ neurotic, 710
“ rheumatic, 722
“ scrofulous, 725
“ theory of, 703
“ uric-acid, 707
Diet, in skin-diseases, 465
“ Oertel's, 124
“ purin-free, 465
“ salt-free, 140, 461
“ uric-acid free, 140
Dietaries, 97
Dietetics, diagnostic, 437
Digalen, in diagnosis, 303
Digestants, in diagnosis, 312
Digestion, physiology of, 851
Digitalis, in diagnosis, 301, 303
“ in etiology, 65
Diphtheria, 114
“ antitoxin, 268
“ in etiology, 686
Disease, drugs in etiology of, 43
“ exacerbation of, 15
“ periodicity of, 15
“ seasonal prevalence of, 15
“ simulation of, 16
Disorientation, 942
Distomiasis, 108
Diuretics, in diagnosis, 314, 315
“ saline, 318
Diuretin, in diagnosis, 317
Dose, 27
Dracontiasis, 111
Dream states, 944
Dreams, 332
Dropsy, hypodermic relief of, 159
Drugs, detection of, in the urine, 38
“ eruptions from, 35
“ in the etiology of disease, 43, 89
“ incompatible, 28
“ interfering action of, in diagnosis, 30
“ interfering action of, in urinary examinations, 40
Dynamometers, 993
Dysentery, 114
Dysmenorrhea, cocain in diagnosis of, 221
Dyspepsia, diet in diagnosis of, 445
“ from food, 130
“ intestinal, 131
“ nervous, 131
Dyspeptic asthma, 137
Dyspnea, characteristics of, 797
“ forms of, 798
“ gastrectatic, 135
“ morphin in diagnosis of, 204
“ phrenic, 800

E.

Eating, how much to eat, 95
" what to eat, 103
" when to eat, 103
Echinococcus disease, 108
Edinger, law of, 988
Effusions, iodids in diagnosis, 193
Egopath, 581
Electrical reactions, 469
Electricity, in etiology, 156
Electro-diagnosis, 466
" in testing muscular insufficiency, 995
Electrotherapeutics, diagnostic, 466
Emaciation, 120
Embryocardia, 776
Emetics, in diagnosis, 319
Emotional life, 587
Emotions, anomalies of, 946
" detection of, 474
Emphysema, cocain test in, 499
" exercises in, 510
" *x*-ray examination of, 624
Enteroclysis, 555
" in diagnosis, 556
Enteroptosis, 408
Enuresis, 401
Eosinophilia, 889
Epilepsy, amyl nitrite in, 370
" bromids in, 234
" cocain in diagnosis of, 218, 320
" diet in, 235
" latent, 235
" signs of, 235
Epithelioma, from drugs, 90
Erb's paralysis, 203
Ergograph, 994
Ergot, in diagnosis, 393
" in etiology, 67
Eruptions, from drugs, 35
" feigned, 35
Eruptive fevers, table of, 732
Erythrol tetranitrate, 369
Erythromelalgia, 604
Esophageal sound, in etiology, 156
Esophagismus, 219
Ether and chloroform, compared, 67
" " " in diagnosis, 207, 211
Ethereal sulphates, 476
Etherization, rectal, 63
Ethyl iodid, 197
Etiologic-diagnostic-therapeutics, 681
Euphthalmin, 215, 298
Euquinin, 241
Examination, incomplete, 2
" methods of, 6
Exophthalmic goiter, diagnosis of, 353, 354
Expectoration, albuminous, 176
Exudates and transudates, 604
Eye, adrenalin instillations, 339
" cocain in diagnosis of, 214
" functional tests for, 972
Eyeball, nerves of, 969

F.

Facial nerve, lesions of, 980
" " paralysis of, 980
Faradic current, 467
Feces, conclusions concerning, 877
" examination of, 872
" macroscopic examination of, 873
" microscopic examination of, 875
Feeding, forced, 166
" rectal, 453
Feminism, 345
Ferrum, in etiology, 70
Fever, aseptic, 251
" bacterial, 250
" drugs which reduce, 203
" from constipation, 293
" glandular, 730
" growth, 255
" hay, 399
" hysterical, 252
" nervous, 251
" syphilitic, 250
Fevers, ephemeral, 114
Fibrolysin, in diagnosis, 404
Filariasis, 111
Filtration, nasal, 810
Fish, poisoning by, 106
Fissure, diagnosis of, 392
Fistulas, diagnosis of, 245, 247, 265
Flight of ideas, 944
Fluorescein, 393
Fluoroform, in diagnosis, 394
Fluoroscope, 619
Food, caloric value of, 96
" caloric value table, 98
" classification of, 96
" diseases caused by, 107
" in etiology of disease, 95
" in etiology of heart-diseases, 145
" in etiology of nervous diseases, 147
" in etiology of skin-diseases, 149
" ingestion of, in diagnosis, 452
" poisoning by, 105
" retention of, in stomach, 451
" therapeutics of, 437
Foods, iron contents of, 150
Foot and mouth disease, 114
" impressions of, 1001
" sufficiency of, 1000
" weak, 1000
Footwear, 1005

Foreign bodies, *x*-ray examination of, 648
Formic acid, for increasing muscular power, 996
Fractures, *x*-ray examination of, 646
Freezing, in diagnosis, 597
Fright element, 206
Frigotherapy, 603

G.

Gait, varieties of, 926
Galactagogs, 746
Gall-bladder, puncture of, 176
Gall-stones, Carlsbad treatment for, 391
“ cholagen in, 389
“ diagnosis of, 389
“ formation of, 389
“ olive oil in, 391, 398
“ *x*-ray examination of, 641
Galvanic current, 468
Galvano-therapy, diagnostic, 472
Gangrene, from drugs, 90
Gargling, 74
Gases, intestinal, 478
“ stomach, 287
Gastralgia, electricity in diagnosis of, 473
Gastric acidity, 323
“ activity, 212
“ antacids, 321
“ mucosa, absorptive power of, 194
“ ulcer, diet in, 450
“ ulcer, diet in diagnosis, 497
Gastritis, from drugs, 90
Gastrodiaphany, 554
Gastrointestinal antiseptics, 257
“ diseases in etiology, 687
“ poisons, 261
Gastroptosis, 403
Gastroscopy, 670
Gelsemium, 249
Glandular fever, 730
“ organs, secretions of, 815
Glaucoma, from drugs, 91
Glénard's disease, 408
Glossopharyngeal nerve, lesions of, 983
Glossoplegia, 986
Gluzinski's test, 857
Glycogenesis, 817
Glycosuria, alimentary, 439
“ drugs causing, 90
“ transient, 43
Goiter, simple, 350
Gonorrhea and marriage, 738
Gout, American, 142
“ colchicum in, 188
“ from drugs, 91
Gout, from food, 121
“ guaiacum in, 199
Guaiacum, in diagnosis, 189
Gull's disease, 349
Gymnastics, resistance, 481
“ respiratory, 486
Gyromele, 538

H.

Hallucination, 941
Hay-fever, 399
“ filtration in, 810
Head, *x*-ray examination of, 635
Headaches, calcium chlorid in, 326
“ cocain in diagnosis of, 216
“ sinus, iodids in, 216
Heart, block, 757
“ diagnosis of sufficiency of, 748
“ diseases caused by food, 145
“ diseases, climate in, 430
“ diseases, exercises in, 512
“ inhibition of, 535
“ innervation of, 750
“ murmurs of, 758
“ murmurs, diagnosis of, 382
“ murmurs, review of, 762
“ murmurs, tabular review of, 762, 764
“ pathologic physiology of, 751
“ physiology of, 748
“ rate of, 755
“ reflex, 375, 629
“ reflex, from straining, 55
“ reflex, testing of, 772
“ sounds of, 749
“ sufficiency of, 327, 767
“ tonics, tests of giving, 373
“ valves, lesions of, 758
“ *x*-ray examination of, 627
Heliotherapy, 539
Helmitol, 264
Hematocrit, 899
Hematometer, 898
Hematuria, 836
“ adrenalin in diagnosis of, 343
“ catheter in diagnosis of, 423
“ iodids in diagnosis of, 196
Hemianopsia, 968
Hemoglobin, test for, 893
Hemoglobinemia, 902
Hemoglobinuria, from drugs, 93
Hemophilia, 150
Hemoptysis, amyl nitrite in, 383
“ methylene blue in diagnosis of, 247
Hemorrhage, occult, 448
“ serous, 327
Hemostatics, 325

Hepatic toxemia, 821
Hereditary neuroses, 721
Hernia, incarcerated, 299
Heterophoria, 976
" tests for, 977
High-frequency current, 480
Hirschsprung's disease, 643
Hodgkin's disease, 892
" " arsenic in, 187
Holocain hydrochlorate, 214
Homatropin, 298
Homeopathy, theory of, 80
Hoover's sign, 717
Hot sponge test, 544
Hueter's maneuver, 166
Hydatid cysts, iodids in diagnosis of, 194
Hydrastis, 395
Hydrochloric acid, in diagnosis, 312
" " test for, 863
Hydrogen gas, 395
" " sulphid in etiology, 88
Hydrotherapy, 540
" in constipation, 544
" in gastric neuroses, 543
" in gout, 543
" in ptosis of colon, 544
" in suppuration, 543
Hyperalgesic zones, 928
Hyperchlorhydria, 312, 321, 325, 397, 401
Hyperemia, 544
" in diagnosis, 546
Hypertension, 782
Hyperthyrea, 353
Hyperthyroidism, 932
Hypnosis, chloroform in, 210
Hypnotics, in diagnosis, 332
Hypnotism, in diagnosis, 598
Hypodermic methods, 158
Hypodermoclysis, 547
" in diagnosis, 547
" in etiology, 158
Hypoglossal nerve, lesions of, 986
Hypophosphites, 359
Hypotension, 783
Hypotonicity of muscles, 711
Hysteria, 919
" anesthesia in, 208
" diagnosis of, 714
" disturbed sensations in, 920
" from drugs, 91
" joints in, 720
" jugulation of, 320
" nature of, 596
" paralysis in, 209, 716
" respiration in, 800
" sensory disturbances in, 715
" spasms in, 719
" stigmata of, 714
" surprise treatment of, 470
" traumatic, 720

I.

Icterus, from drugs, 91
Ideopath, 4, 580
Idiocy, amaurotic, 734
Idiosyncrasy, 26
Idiots, cretinoid, 950
Ileus, stomach-tube in, 560
Illusion, 941
Imbecility, 951
Immunity, 267
Impotence, psychic, 231
Impotency, neurasthenic, 989
" from drugs, 91
Incontinence of urine, 297
Indican, 42, 826
" Porter's test for, 826
" test for, 476
Indicanuria, 142, 568, 826
Inebriety, 301
Infantilism, 191, 313, 846
" iodoform in diagnosis of, 198
Inflation, in etiology, 160
" of bladder, 551
" of ear, 548
" of rectum, 550
" of stomach, 551
Influenza, in etiology, 692
Inhibition, cardiac, 535
Insanity, and maternity, 947
" heredity in, 721
" in adolescence, 948
" in climacteric period, 949
" relation of diseases to, 946
Insomnia, 331
" blood-pressure in, 784
Insufficiency, intra-abdominal, 408
Intercostal phonation phenomenon, 517
Intestinal diseases, food in etiology of, 124
" infusions, in etiology, 160
" obstruction, from drugs, 91
Intestines, neuroses of, 870
" pathologic physiology of, 870
" physiology of, 868
" tests for sufficiency of, 872
" x-ray examination of, 642
Intussusception, turpentine in, 406
" inflation in, 550
Iodids, in diagnosis, 189
" in etiology, 68
" test for, 193
Iodin, in diagnosis, 196
" reaction of blood, 900
Iodoform, antituberculous action of, 198
" in diagnosis, 197
" in etiology, 69
Iodopin, in diagnosis, 198
Ipecacuanha, 319
Iridoplegia, 969
Iritis, cocain in diagnosis of, 214

Iron, contents in food, 150
" in diagnosis, 360
" in etiology, 70
" preparations of, 361
Ischemic paralysis, 656

J.

Jaborandi, in diagnosis, 309
" in etiology, 70
Jacobson's method of pelvimetry, 1007
Jaundice, 820
" blood in, 902
" from drugs, 92
" from food, 115, 132
Joints, bandage in diagnosis, 652
" *x*-ray examination of, 647
Justus test, 201

K.

Kataphoresis, 224
Katzenstein's method for testing heart, 772
Kernig's sign, 917
Kidney, chlorid excretion of, 842
" concentration test of, 841
" diseases, from food, 139
" estimation of function of, 837
" indigo-carmin test of, 841
" pathologic physiology of, 831
" physiology of, 828
" potassium iodid test of, 841
" salicylic acid test of, 842
" tests for sufficiency of, 837
Kreotoxism, 105

L.

Labor pains, 221
Labyrinth, disease of, 936
Lactation, 746
Lactic acid ferments, 262
Lactose, 318
Laryngeal paralysis, 984
" stenosis, 205
Laryngismus stridulus, 984
Laryngitis, from drugs, 92
Lavage, in diagnosis, 554
" in etiology, 161
" in pernicious anemia, 558
" of ear, 554
" of intestines, 557
" of stomach, 559
" of vagina, 560
" stomach, in etiology, 162
" urethral, in etiology, 167
" uterine, in etiology, 168
" vaginal, in etiology, 168
Law of Courvoisier, 819
Lead, in etiology, 70
" palsy, 71
Lecithin, 360
Leeches, 150
Lehman's sign, 211
Leprolin, 269
Leprosy, diagnosis of, 308
" iodids in diagnosis of, 195
Leukanemia, 891
Leukemia, 890
" pseudo, 892
" *x*-rays in, 649
Leukocytes, in health, 887
Leukocytosis, 887
" pathologic, 887
Leukopenia, 889
Levulosuria, 439, 827
Lipemia, 901
Lithemia, 142, 455
" electricity in, 478
Lithium benzoate, 390
Litten phenomenon, 518
Liver, affected from drugs, 92
" affected from food, 134
" as an organ of defense, 818
" circulatory disturbances of, 822
" glycogenic function of, 817, 827
" pathologic physiology of, 818
" percussion of, 515
" physiology of, 816
" reflex of, 824
" sufficiency of, 823
" tenderness of, 567
" transmitted palpation of, 477, 823
Locomotor ataxia, 922
" " diagnosis of, 379
" " gait in, 926
Lumbago, strapping in, 653
Lumbar puncture, in diagnosis, 609
" " in etiology, 172
Lung, ankylosis of, 511
" borders, changes in, 515
" postural dullness of, 492
" pretuberculous, 495
" reflex of, 497
" syphilis of, 191
Lungs, in cardiac incompensation, 753
" *x*-ray examination of, 621

M.

Maddox rod, 977
Magnet, in diagnosis, 561
Malaria, amyl nitrite in, 370
" arsenic in, 187
" blood in, 901
" diagnosis of, 241
" etiology of, 109
" hemorrhagic, 92
" quinin in, 241

Mallein, 270
Malt, 312
Malta fever, 115
Mammary gland, 844
Marriage, in etiology, 737
Marrow, in diagnosis, 335
Massage, in diagnosis, 562
  " in genito-urinary diseases, 569
  " in headaches, 576
  " in joint diseases, 562
  " in liver diseases, 567
  " in nervous pain, 565
  " in renal disease, 573
  " in spinal disease, 565
  " of skin, 357
  " physiology of, 561
  " testicular, 346
  " therapeutics of, 562
Mastication, 103
Masturbation, 221, 230, 245
Measles, in etiology, 692
Meat, poisoning by, 105
Medicinal rashes, 35
Melanuria, 143
Memory, 940
  " anomalies of, 945
Ménière's disease, 936
Meningismus, 610
Meningitis, serum in diagnosis of, 277
Menopause, 335, 736
Menstruation, 735
  " nasal anomalies in, 229
Mercurial fever, 201
  " reaction, 201
Mercurialism, 73
Mercury, in diagnosis, 199
  " in etiology, 72
Metabolism, 102, 429
  " carbohydrate, 443
Metallotherapy, 595
Metatarsalgia, 1003
Meteorismus, 135
Methods for testing heart, 767
Methyl iodid, 307
Methylene-blue, in diagnosis, 243
  " in testing kidney, 839
Micturition, frequent, 421
Migraine, amyl nitrite in, 370
  " thyroids in, 352
Milk-diet, 98
Milk-products, poisoning by, 106
Milk-sickness, 115
Mind, 939
Mono-diet, 446
Monopharmacy, 24
Morphin, habit, 77
  " in diagnosis, 204
  " in etiology, 76
Mouth-breathing, 805
Mucous-colic, 412
Mucus, test for, 866, 874
Munsterberg's tests, 584
Murexid test, 308
Murmurs, heart, 758
  " subclavian, 528
Muscles, hypotonicity of, 711
  " pathology of, 986
  " physiology of, 986
Muscular dystrophies, 734
  " exercises, in asthma, 991
  " " in stammering, 991
  " " in tabes, 990
  " " in tics, 990
  " " therapeutics of, 997
  " insufficiency, 997
  " " tests for, 992
  " power, drugs for, 996
  " sufficiency, 986
Mushroom-poisoning, 107
Myelomata, 367
Myocardial insufficiency, electricity in, 447
Myotonic reaction, 469
Myxedema, 349, 950

N.

Narcolepsy, 148
Nasal breath-pictures, 809
  " filtration, 810
  " patency, 805
Nationality in etiology, 12
Nauheim baths, 484
Neck, *x*-ray examination of, 640
Negativism, 945
Nematodes, 110
Nephritis, blood-pressure in, 785
  " diet in, 462
  " from drugs, 93
  " iodids in diagnosis of, 195
Nephrolithiasis, 143
Nerves, cerebral, diseases of, 966
Nervous diseases, blood-pressure in, 783
  " " climate in, 431
  " " from food, 147
  " system, in children, 726
  " " pathologic physiology of, 906
  " " physiology of, 903
  " " sensory path of, 906
  " " tests for sufficiency of, 914
Neuralgia, diagnosis by drugs, 248, 306, 362, 370
  " diagnosis by electricity, 473
  " psychrotherapy in, 600
Neurasthenia, anesthesia in, 921
  " congestive, 417
  " signs of, 710
  " splanchnic, 408, 477
  " toxico-, 822

Neuromata, 965
Neuroses, barometric, 16
  " hereditary, 721
  " psychic condition of, 951
  " traumatic, 921
Neurotic diseases, 721
Nicotin, 85
Nitroglycerin, 369
Nitrous oxid, 62
Nose, as a reflex center, 215, 218
Novocain, 227
Nucleins, 365
Nucleo-albumin, test for, 141
Nutritional disturbances, 455
Nystagmus, 970

O.

Obesity, diet in, 457
  " diuretics in diagnosis of, 316
  " from food, 123
  " thyroids in, 351
Obsessions, 942
Occult blood, tests for, 448
Occupation, in etiology, 12
Ochronosis, 45
Odontalgia, diagnosis of, 219
Oertel diet, 124, 460
Ointments, absorption of, 357
Olfactory nerve, diseases of, 966
Olive oil, in diagnosis, 396
Operations, in etiology, 168
Ophthalmoplegia, 972
Ophthalmo-reaction, 283
Opium, in diagnosis, 204
  " in etiology, 76
Opsonic index, 271
Opsonins, in diagnosis, 274
Optic nerve, diseases of, 966
  " neuritis, from drugs, 93
Oral sepsis, 74
Organotherapy, 335
Orthodiascopy, 627
Orthoform, in diagnosis, 228
Orthophoria, 976
Orthostatic albuminuria, 327, 834
Osteomalacia, 344
Otosclerosis, 471
Ovarian preparations, 335
Oxalates, 42
Oxaluria, 144

P.

Pain, abdominal, diagnosis of, 206
  " adrenalin in, 342
  " analgesics in, 34
  " diagnosis of, 203
Painful heel, 1003
Pains, 927
Pains in the stomach, 397
Pallesthesia, 672
Palmar sign, 790
Pancreas, cysts of, 847
  " diseases of, from food, 135
  " pathologic physiology of, 845
  " physiology of, 845
  " tests for sufficiency of, 848
  " tumors of, 847
Pancreatic activity, test for, 269
  " calculi, 848
  " diabetes, 850
  " function, test for, 197
  " hemorrhage, 846
  " infantilism, 846
  " preparations, 313
Pancreatitis, 847
Pankreon, 313
Paraldehyde, in etiology, 78
Paralysis, from drugs, 93
  " functional, 717
  " general, 948
  " hysterical, 716
  " in children, 733
  " laryngeal, 984
  " ocular, 972
  " peripheral, 912
  " pseudo, 734
  " tests for, 928
  " types of, 910
Parasites, animal, 107
Parasiticides, in diagnosis, 358
Parathyroids, 329, 816
Parenchymatous aspiration, 176
Paresis, 948
Parotitis, from drugs, 94
Paste of Unna, 359
Patient, psychology of, 18
Pawlow, investigations of, 103
Pelvic sufficiency, 1007
Pelvimetry, 1007
Pelvis, measurement of, 1007
  " *x*-ray examination of, 645
Pentoses, 42, 438
Pepsin, in diagnosis, 314
Perception, anomalies of, 939
Percussion, palpatory, 770
Perhydrol, in diagnosis, 264
Pericardial effusions, diagnosis of, 309
Pericardium, murmurs of, 76
  " puncture of, 173
  " *x*-ray examination of, 630
Peroxid of hydrogen, in diagnosis, 264
  " " " in etiology, 78
Pertussis, chloroform in, 210
  " diagnosis of, 253, 269, 394
  " in etiology, 78
  " strapping in, 665
Pessaries, in diagnosis, 576
Phantom tumors, diagnosis of, 208
Phenacetin, in etiology, 78

Phenolphthalein, 390
Phenomenon, cardio-splanchnic, 769
Phloridzin, in testing kidneys, 839
Phobias, 943
Phosphates, tests for, 569
Phosphaturia, 144, 324
Phosphorus, 360
  " for increasing muscular power, 997
  " in etiology, 78
Phrenic dyspnea, 800
  " shadows, table of, 521
Phthisis and digestion, 138
Physical diagnosis, of respiratory diseases, 806
Pica, 133
Picric acid, in etiology, 78
Pilocarpin, in diagnosis, 311
  " in etiology, 70
Pithiatism, 596
Plethora, 365, 415
Pleura, friction sounds of, 523
  " puncture of, 174
Pleural effusions, *x*-ray examination of, 625
  " reflex, 175
Pleuritis, exercises in, 511
  " iodids in diagnosis of, 194
Pleuro-pericardial murmurs, 766
Plumbism, 70
  " blood in, 900
Pneumatometry, 812
Pneumogastric nerve, lesions of, 983
Pneumonia, blood in, 887
  " exercises in, 511
  " from chloroform, 57
  " in etiology, 692
  " morphin in diagnosis of, 205
  " *x*-ray examination of, 624
Pneumothorax, *x*-ray examination of, 626
Pollantin, 399
Polycythemia, 884
Polypharmacy, 24
Polyuria, 319
Postural dullness, of lungs, 492
Potassium chlorate, in etiology, 78
  " tellurite, 400
Precipitant solutions, 29
Pregnancy, diagnosis of, 731
  " duration of, 1011
  " kidney of, 348
  " pathology of, 741
  " physiology of, 741
  " *x*-rays in, 645
Prejudiced preconception, 6
Premature ejaculation, 232
Presbyopia, 974
Prescriber, individual, 25
Prescribing, technic of, 22
Pressure-therapy, 574
Previous diseases, in etiology, 14
  " residence, in etiology, 13
Priapism, 223
Probilin, 391
Propinquity, in etiology, 722, 740
Proprietaries, prescriber of, 23
Prostate, hypertrophy of, 153
  " " *x*-rays for, 645
Prostatorrhea, 571
Protectives, in diagnosis, 358
Proteids, varieties of, 834
Pseudo-leukemia, 892
Psittacosis, 116
Psoriasis, arsenic in, 186
  " chrysarobin in, 196
Psychasthenia, 713
Psychologic tests, 938
Psychomotor activity, 945
Psychoses, autotoxic, 950
  " from drugs, 94
  " of infection and exhaustion, 949
Psychotherapy, 579
  " coercive measures in, 592
  " concentration in, 590
  " diversion in, 587
  " expectant attention in, 591
  " in diagnosis, 596, 598
  " in hysteria, 597
  " methods of, 583
  " persuasion in, 595
Psychrotherapy, 599
Ptosis, 969
Ptyalism, diagnosis of, 197
Puberty, diseases of, 735
Puerperium, 745
Pulmonary anemia, 363, 493
  " tumors, *x*-ray examination of, 626
Pulsus paradoxus, 534
Puncture, antral, 617
  " in diagnosis, 604
  " in etiology, 70
  " lumbar, 172, 609
  " of ascites, 606
  " of bladder, 617
  " of brain, 608
  " of cysts, 607
  " of gall-bladder, 607
  " of joints, 608
  " of liver, 612
  " of lungs, 613
  " of pericardium, 173, 616
  " of pleura, 174
  " of scrotum, 618
  " of spleen, 612
  " visceral, 176
Purgation, objections to, 259

Purin-free diet, 465
Purpura, from drugs, 94
Pus, tuberculous, 606
Pyelography, 644
Pyelonephritis, diagnosis of, 244
Pyloric obstruction, 398
" spasm, 397, 853
Pylorus, insufficiency of, 551
Pyramidal tract, 905
Pyramidon, 253
Pyuria, 833

Q.

Quinin, in diagnosis, 241
" in etiology, 79
Quinquad's sign, 681

R.

Radio-diagnosis, 618
Radium, 183
Rashes, medicinal, 35
Raynaud's disease, 650
Reaction of degeneration, 469
Recklinghausen's disease, 965
Rectal etherization, 63
" feeding, 453
Reduction cure, 458
Reflex, aortic, 633
" heart, 375, 629
" intestinal, 291
" lung, 497
" of Babinski, 595, 718, 960
" of Gordon, 960
" of liver, 824
" of Oppenheim, 960
" penile, 230
" stomach, 859, 860
" tarsophalangeal, 961
Reflexes, pathologic, 960
" varieties of, 957
" vertebral, 677, 957
Relaxation, gospel of, 589
Religious-therapeutics, 594
Renal sufficiency, 837
Rennin, 866
Resistance exercises, 481
Respiration, 796
" movements of, 796
" tissue, 797
Respiratory diseases and nervous system, 802
" " and temperature, 803
" " physical diagnosis of, 806
" gymnastics, 501
" rhythm, 537
Rest-cure, partial, 447, 456
Rheumatic nodules, 256
Rheumatism, diagnosis of, 254
" food in etiology, 122
" in children, 723
" serum in diagnosis of, 275
" thyroids in, 352
Rheumatoid arthritis, 263
" diathesis, 722
Rhinitis, iodids in diagnosis of, 195
Rickets, 728
" from food, 122
Rigg's disease, 260
Rodagen, 355
Roseola, diagnosis of, 650
Rubber-bandage, in diagnosis, 650

S.

Sacro-iliac disease, 664
Sahli's desmoid test, 243
Salicylates, in diagnosis, 253, 254
" in etiology, 81
Saline diuretics, 318
Salol, in diagnosis, 266
" in etiology, 82
Salomon's test, 857
Salt-free diet, in diagnosis, 461
" " food, 140
" hunger, 464
" in diagnosis, 401
Saturnism, 70
Scarlet fever, in etiology, 693
Scars, electricity for, 479
Schott treatment, for obesity, 460
Scopolamin, in anesthesia, 595
Scrofula, arsenic in, 187
Scrofulous diathesis, 725
Scurvy, from food, 123
" in children, 126
Secretin, 845
Secretion, 336
Segregation of urine, 435
Semen, test for, 571
Senile insanity, 949
Sensation, disturbed, in brain-lesions, 921
" disturbed, in spinal-lesions, 922
" in ataxia, 922
" in neuritis, 925
" in syringomyelia, 925
Sensory disturbances, in hysteria, 715
Separators, urinary, 435
Septicemia, 366
Serum, in diagnosis, 275
Sex, in etiology, 11
Sexual act, 230
Shock, 345, 656
" blood in, 893
" blood-pressure in, 785

Shoes, correct, 1006
Silver, in etiology, 82
Sinuses, transillumination of, 668
“ *x*-ray examination of, 649
Sinusoidalization, diagnostic, 495
Sismotherapy, 677
Skin-diseases, food in, 149
Skull, percussion of, 611
Sleep, 330
Smell, disturbances of, 966
Smith's minimetric method, 87
Sodium bicarbonate, in diagnosis, 322
“ citrate, 392
Solanin, 106
Solar rays, in diagnosis, 539
Solutions, precipitant, 29
Sound, esophageal, in etiology, 157
Sounds, in diseases of bladder, 657
“ in diseases of stomach, 551
“ in diseases of urethra, 650
“ in diseases of uterus, 662
“ in esophageal-disease, 658
“ in rectal diseases, 659
Spasmodic broncho-stenosis, 383
Spasms, 912
Spastic constipation, 292
Special periods, in etiology, 725
Speech, disorders of, 928
Sphygmomanometer, 787
Spinal accessory nerve, lesions of, 985
Spinal-anesthesia, 225
Spinal-cord, focal lesions of, 961
“ “ localization of functions, 953
“ “ localization of lesions, 953
“ “ segmental level of, 953
“ “ topical diagnosis of, 953
Spirocheta pallida, 31
“ “ staining for, 698
Spirographs, 809
Spirometry, 813
Status lymphaticus, 61
Steapsin, 845
Stethophonometry, 773
Stokes-Adams' disease, 300, 757
Stomach, absorbent power of, 862
“ acute dilatation of, 135
“ analysis of contents of, 863
“ carcinoma of, 856
“ conclusions from analysis of, 866
“ digestive power of, 865
“ motor insufficiency of, 477, 858
“ motor neuroses of, 852
“ motor power of, 266, 404, 859
“ motor power, test of, 399
“ outlining of, 402
“ pathologic physiology of, 852
“ pepsin in, 867
“ physiology of, 851
Stomach, pyloric spasm of, 853
“ Salomon's test, 857
“ sensory neuroses of, 854
“ tests for sufficiency of, 859
“ total acidity of, 865
“ withdrawal of contents of, 162
“ *x*-ray examination of, 642
Storck's method, 164
Strabismus, 971
Strapping, abdominal, 663
“ in pertussis, 665
“ in varicocele, 665
“ of breast, 665
Straus, sign of, 310
Streptococcus serum, 275
Strophanthus, 303
Strychnin, in diagnosis, 401
“ in etiology, 83
Subclavian murmurs, 528
Sudanophilia, 900
Sugar, in diagnosis, 401
“ milk, 438
Suggestibility, 945
“ test of, 474
Suggestion, 20
“ amyl nitrite in, 384
Sulphonal, in etiology, 83
Supporters, abdominal, 407
Suppuration of the ear, 387
Suprarenal extract, in etiology, 84
“ gland and diabetes, 118
“ insufficiency, 336, 344
“ preparations, 336
Suspension, in diagnosis, 666
Symptoms, incomplete development of, 10
“ misinterpretation of, 4
Syphilis, acquired, 695
“ and marriage, 739
“ and tuberculosis, 191
“ atoxyl in, 188
“ hereditary, 190, 694
“ in etiology, 693
“ iodids in, 189
“ Justus' test for, 201
“ mercury in, 199
“ mixed treatment for, 192
“ prognosis of, 200
“ prophylaxis of, 75
“ serum in diagnosis of, 277
“ symptoms of, 695
“ therapeutic test of, 199, 200
“ thiosinamin in, 406
Syringomyelia, 925

T.

Table of heart-murmurs, 764
Tachycardia, aconite in, 386

Tachycardia, bandage in diagnosis of, 650
" digitalis in, 306
" paroxysmal, 755
Talipes, prognostic test for, 997
Tamponade, in diagnosis, 667
Teeth, anesthesia of, 223
Temperature, in pulmonary diseases, 803
Tension, intra-abdominal, 407
Test of condition, 998
Testicular preparations, 345
" insufficiency, 345
Test-meals, 862, 872
Tests, for heart sufficiency, 767
" for hepatic sufficiency, 823
" for vagus sufficiency, 777
Tetanus, from drugs, 94
Tetany, electricity in diagnosis of, 473
" from drugs, 94
Theocin, in diagnosis, 319
Thinking, anomalies of, 942
Thiosinamin, in diagnosis, 404
Thoracentesis, 175
Thoracometry, 811
Thymol, in diagnosis, 238, 240, 261
Thymus gland, 816
" " preparations of, 346
Thymus tod, 61
Thyroid extract, in etiology, 85
Thyroid, hypertrophy of, 347
" preparations of, 346
Thyroidectin, 355
Thyroidism, 85
Thyroids, in diagnosis, 347
Tinnitus aurium, 982
" " from quinin, 80
Tissue respiration, 797
Tobacco, in etiology, 85
Tongue, neuroses of, 979
Tonics, 359
" cardiac, 304
" in diagnosis, 362
Tonsillitis, in etiology, 699
Toothache, 325
" electricity in diagnosis of, 471
Torticollis, 985
Toxemia, gastrointestinal, 133
" hepatic, 821
Tracheal traction test, 305
Transference, 715
Transillumination, of larynx, 668
" of mastoid, 671
" of scrotum, 670
" of sinuses, 668
" of stomach, 670
Traumatic hysteria, 720
" neuroses, 921
Treatment, 17
" psychic factor in, 19
Treatment, reliance on, 9
Tremor, 932
Trichiniasis, 110
Trichocephalus dispar, 112
Trigeminus, diseases of, 978
" neuralgia of, 979
Trional, in etiology, 83
Trophic disturbances, 932
Trypanosome disease, arsenic in, 188
Trypanosomiasis, 112
Tubercle bacilli, in blood, 901
Tuberculin, in diagnosis, 277, 508
" inoculation, 281
Tuberculosis and marriage, 738
" blister in diagnosis of, 308
" blood-pressure in, 784, 786
" chloranemia in, 508
" emphysema in, 495
" exercises in, 506
" from food, 116
" heart in, 499
" in children, 728
" indirect diagnosis of, 284
" morphin in diagnosis of, 204
" pus of, 606
" tuberculin in diagnosis of, 377
" *x*-ray examination in, 622
Tucker remedy, 217
Tufnell diet, 464
Tuning-fork, for bone sensibility, 672
" for hearing power, 671
" in appendicitis, 672
" in auscultation, 673
" in nervous diseases, 672
Turpentine, in diagnosis, 366, 406
Typhoid fever, Baruch's sign in, 541
" " blood in, 889
" " blood-pressure in, 785
" " cathartics in diagnosis of, 295
" " from food, 116
" " in children, 731
" " in etiology, 702
" " serum-test for, 286

U.

Uffelmann's test, 864
Ulcer, gastric, diagnosis of, 313, 855
Uncinariasis, 111
Untruth, ethics of, 21
Urea, determination of, 824
Uremia, 837
" latent, 316
Ureteral kinks, 436
Urethra, anesthesia of, 222
Urethral affections, adrenalin in, 343
" spasm, 154